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Volume 81 August 8, 1918 Number 6

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Volume 81 — NEW YORK, THURSDAY, AUGUST 8, 1918 — Number 6

Two More Great Yards Now Producing Ships

SIXTY-TWO more shipways joined the company of producing yards during the week, when Bristol and Hog Island celebrated their first launchings. Agency yards both, they are constructing bridge-shop-fabricated vessels. Last year's all-summer battle over quantity ship production ended eleven months ago with the decision to build steel ships in agency yards, which is already justified by the event. The course taken put the full strength of the nation into shipbuilding. Figures published in *Engineering-News Record* of July 4, p. 40, reflected the tremendous ship output attained. With the two great yards that began to launch ships this week, we are closely approaching the maximum rate of production there forecast.

New Speed Records Show Increasing Efficiency

WHILE massing more resources on the work of building ships, we are progressing also in efficiency. Ever new marvels of achievement seem to be the order of the day. At Ecorse, in Michigan, they built a steel vesel of 3500 tons in fourteen working days from keel-laying to launching; the "Tuckahoe" record was far outdone by this performance. Yet within a few days afterwards, another yard set a much more wonderful mark of speed. Alameda launched a 12,000-ton ship after but twenty-four days of construction, or thirty calendar days. "Invincible" is the name of this remarkable vessel, launched on August 4. At the shipyard's present pace, the record is not likely to stand for long. Not a yard but is driving its work at top speed; and the top speed of today is not limited by what was considered possible yesterday.

Imperial Valley Seepage Case

ENGINEERS throughout the West have been waiting anxiously for the decision in the Imperial Valley seepage case reported on p. 237 of the last issue. The court found in favor of the canal company. The case will probably be carried to the higher courts, and should the decision there be reversed, the result would be a serious blow to irrigation properties, in California at least. It would force the lining of all canals that were in any considerable degree leaky, an expense that would in general be prohibitive. In districts wealthy enough to be able to meet the high cost of lining, the result would be that lands favorably located and not waterlogged would have to pay for the drainage of those troubled with water. Further progress of the case will be waited with interest. Meanwhile one cannot but believe that cases of this sort serve to show the necessity for constant emphasis upon the ultimate need for drainage, even though the character of the drainage works cannot be determined when the project is planned. Were irrigationists taught from the start that irrigation necessarily implies drainage, cases of this sort would not arise.

Work for Every Cleveland Soldier When War Is Over

RECONSTRUCTION problems demand early attention by every city of the country, but few seem to be acting accordingly. Cleveland affords a marked exception. Following the general plan mentioned by City Engineer Robert Hoffmann on p. 36 of this journal for July 4, Mayor Davis of Cleveland has asked all his department heads to submit to him an outline of needed public improvements. These reports will be referred to the City Planning Commission for weighing and coördination. On approval all preliminary details can be worked out so construction may be started as soon as the war is over. By this means the city will provide work for all its returned soldiers and at the same time carry out the elements of a well conceived city plan. Other cities will do well to follow Cleveland's lead.

Efficiency, Like Charity, Should Begin at Home

EMPLOYING an efficiency engineer at city expense and placing him at the service of local industrial plants without charge to the latter is the novel proposition made by the Jersey City Commissioner of Finance and Revenue. In most cities of the country charity of this sort should begin at home. Relatively few American cities recognize the value of continuous expert engineering service and fewer yet are willing to pay for it and to leave the engineer who gives it free from the deadening influence of party politics.

Economical Size of Motor Truck Must Be Determined

REVIEWING the highway transportation problem, it appears to divide under three main heads. The first of these represents an established fact, the second propounds an interesting question, while the third deals with a most perplexing problem demanding immediate solution. That motor truck transportation over good roads is desirable for the short-haul up to fifty or sixty miles cannot longer be doubted. The large proportion of freight which, in any event, has to be loaded

upon motor trucks at one or both ends, and the economics of railway transportation which appears to demand a low mileage per car day, unite to make the use of trucks both convenient and economical. The question as to whether the truck will ultimately be found desirable for the long haul is interesting but more or less academic. Academic because it has no particular bearing upon the construction of the roads. If the road slab is put in condition to carry the short haul truck, the length of haul can be regulated at will. The problem demanding immediate solution, therefore, is, What is the heaviest economical size of truck? This must be settled before engineers can form any logical opinion as to the thickness of the road slab. The problem is one dependent upon the mechanical limitations of the truck, the economical size of load and the heaviest wheel loads for which it will pay to allow in designing highways. Truck manufacturers, truck users and highway engineers should get together and bend every effort to solve the problem.

Long Municipal Service Honored in England

APPRECIATION of long terms of municipal engineering service is more common in England than in the United States—partly because they are more frequent there than here. On the recent retirement of C. H. Cooper, borough engineer and surveyor of Wimbledon, after forty years service for the borough, the Municipal Council put upon its records its appreciation of Mr. Cooper's professional skill and devoted service, presented him with a piece of plate, conferred the freedom of the borough upon him, and appointed him consulting engineer and surveyor to the council at a salary of $500 a year. Acting further upon the principle of recognizing faithful service, the council promoted the assistant engineer and surveyor to the position held so long by Mr. Cooper, and advanced the chief architectural assistant and draftsman to the position of assistant engineer and surveyor. It would be a pleasure to *Engineering News-Record* to record oftener than it is able to do similar action on the part of American municipalities. Lest it be supposed that the conditions surrounding the municipal engineer in England are wholly ideal, attention may here be called to the brief abstract of the inaugural address of the president of the Institution of Municipal and County Engineers of Great Britain, printed on p. 274 of this issue. The status of the municipal engineer in this country deserves the careful attention of the municipal engineers themselves, the engineering societies, city councils and friends of good municipal government.

Is the Shipping Board Against Concrete Ships?

FOR some time vague rumors have credited the Shipping Board with an unexplained but quite definite opposition to the growing favor in which concrete ships are held by the experts of the Concrete Ship Department of the Emergency Fleet Corporation. Contracts for a number of such ships have been let and progress is being made in the five government yards, but the Board, like the prospective bridegroom in the old story, is reported to have "lost its enthusiasm." Those who have been slow to believe these rumors will begin to wonder if they are not true when they read of the interference of the Board in the War Department's concrete ship program, as outlined in the news pages of this issue. The Water Transport Branch of the Army has under contract and design only very small vessels, either engineless or of such low power as not to interfere with the engine requirements of the Shipping Board. The cement, aggregate and steel requirements are likewise small enough to be satisfied in local markets. While there is much to be said in favor of the concentration of the country's shipbuilding in one agency, the Shipping Board will be subjecting itself to a criticism of motives if it now raises objection to the War Department's proceeding with the concrete boats it has planned.

Water Waste Curtails Output of War Materials

VIGOROUS steps to prevent water waste at Philadelphia should be taken. On a recent day the consumption *and waste* broke all previous records, resulting in numerous complaints of low pressure and water shortage and curtailing the output of a number of plants working exclusively on emergency orders for war supplies. The daily pumpage reached 359,000,000 gal., or more than 200 per capita. Besides cutting down war supplies this means increased costs for pumping and filtration, increased fire risks, increased danger to health from overworked water filters and an unnecessary draft on the limited coal supply of the country. Engineers in the Bureau of Water realize the gravity of the situation and would have averted it long ago could they have had the backing of the City Council and the public. What is the Engineers' Club of Philadelphia doing to help stop the water waste for which Philadelphia has long been notorious?

New York's Dual Subway System Is Opened

WITH the formal initiation last Thursday of train service over the new trunk lines in Manhattan and the Bronx of its dual subway system, New York City has in operation the major portion of the greatest rapid transit system in the world. The new system, the present enlargement of which has cost more than the Panama Canal, and perhaps more than any other railroad or public utility yet built in the world, will transport annually 3,000,000,000 persons. It will have a total trackage of more than 600 miles, and several of the trips which can be made on it are far longer than the distance that may be traversed for a single fare on any other rapid transit system in existence. The construction of the lines under streets carrying the densest of vehicle traffic, through treacherous ground adjacent to heavy skyscrapers, beneath the East and Harlem Rivers and finally over outlying areas on steel and concrete elevated lines, presented an array of construction difficulties which can safely be said to have surpassed those of any other work ever undertaken. The conditions have called for well nigh every known type of construction, and in many cases have required the development of new methods, which have contributed greatly

to the science of construction. Those who conceived, designed and built the great system deserve the highest praise for the vision with which the work as a whole was planned, and for the skill with which it was executed. There may be details in which the system will require modification, but no work of this magnitude whose construction must occupy a long period of time, during which conditions are bound to change, can be carried out without minor alterations in plan. It is true that the system has been put in operation somewhat later than was intended, and that important work remains to be done in adjusting the construction contracts before the dual subway can be completed. War conditions, however, have intervened since the work was undertaken, and the completion by Aug. 1 of the most important trunk lines, under the present difficulties imposed upon construction work, is in itself a monument to the builders.

The Times Square Tangle Becomes a Reality

NO SOONER was the new "H" subway system in New York City opened than the public afforded a demonstration of the fact that accustomed ways are hard to change, and incidentally a foretaste of what many expect will happen at Times Square when the East River tunnels are completed and the new Broadway subway brings thousands of Brooklynites to that district during the rush hours. The crush at the Times Square and Grand Central stations which made it necessary to discontinue temporarily the 42nd Street shuttle service on the cross of the "H" between the two new lines until passageways could be improved and adequate signs posted for the direction of passengers was not due primarily to the planning of the new system. It was chargeable, in great part, to the fact that the opening took place in the middle of the week. Had the new service been inaugurated on Saturday night the public would have had a full holiday to become acquainted with its workings before the arrival of the next rush hour.

In any case there would have been many thousands arriving at the Grand Central Terminal and wishing to reach the upper West Side, and many residing in that section who wished to reach the district below the Grand Central Terminal, who would have attempted to use the 42nd Street shuttle until they learned that it was incapable of carrying the traffic. This was the strongest argument advanced for rearranging the layout at Times Square to provide for operating a small percentage of the trains on the upper Broadway line to the Grand Central. In time, however, those who wish to reach upper Broadway in the morning will move out of the district served by the New York Central R. R., and those who must reach the Grand Central district will move away from the upper Broadway line, so that the shuttle traffic under 42nd Street will be reduced to passengers other than commuters using the New York Central, and to non-rush-hour traffic, which it will be able to accommodate.

The more serious situation at Times Square is that presented by the arrangement of the Broadway Subway station, underneath that of the Interborough. This station as built is provided with 300-ft. express platforms having exits only at the ends. It is far below the street, and stairs and passageways are narrow and will undoubtedly prove wholly inadequate. As was described on page 452 of *Engineering Record* of March 22, 1917, this station was redesigned to meet the obvious needs of the traffic, and the new design was at one time actually adopted. It failed of execution and the inadequate station which was planned years ago without the advantage of present knowledge of subway traffic was built because certain officials took umbrage at the refusal of the contractor to install cast-iron columns for a price which the contractor stated to be less than the cost of the columns at the foundry. This deplorable incident, which is of a type that can never be excused in connection with important public work, was fully commented on by this journal on p. 819 of its issue of Nov. 1, 1917. As was pointed out at the conclusion of that editorial, it is to be expected that this station will have to be rebuilt at considerable expense before it is long in operation.

Does Commission Control Remove the Hazard of Investment?

AT a recent hearing upon the petition of one of the larger water companies of this country for increase in revenue to meet its abnormal increase in operating costs, the significant suggestion was made that the commissions themselves, rather than the corporations, were on trial in pending petitions for relief presented by public utility corporations to the public service commissions or other regulatory bodies all over the country. At the same hearing one of the commissioners expressed himself as not interested in the question of dividends, but as being very much interested in the maintenance of service by the company.

That substantial relief is urgently needed in many cases no fair-minded man would deny. It has been recognized clearly for several years by operators and students of economic problems that the number of examples of seriously declining service rendered by different public utilities was growing with dangerous rapidity, due to advances in labor, material and supply costs, and that the necessary relief, through increase in rates and revenue, was not being given by the regulating authorities. The country has been paying a very high price for this sort of public policy and lack of sound commercial sense toward the railroads for several years, and is now facing similar conditions in other fields.

This situation raises some interesting problems of public policy. Is the government bent upon extending its functions to the limit of general public ownership of the utilities—steam and electric railroads, telegraph, telephone, power, gas, electric light and water plants—or is the fundamental idea of regulation and control still the dominating one? Obviously, ownership and operation will involve enormously increased personnel over that of the regulatory bodies. Is it possible that the country can be ready for this additional step as a permanent measure?

In the more limited field of public regulation or control, too, the situation presents some vital questions of policy, one of which, of particular interest at this time, is suggested by the water works situation referred to above. For years the public service commissions have stood on the principle that commission con-

trol removed the hazard of investment and that public corporations thus protected must therefore be content with a smaller rate of return; while the commercial world and even the Supreme Court has held that the corporation should carry the hazard of the business and be compensated accordingly. It is fair to inquire, now that the war has enormously increased the hazard carried by the corporations and correspondingly reduced their ability to maintain a reasonable return, and in many cases to preserve the integrity of the properties themselves, whether the commissions are living up to their pronouncements—whether they are removing the hazards of business and granting the necessary relief. That the conditions are abnormal and most difficult is true. That some measure of relief has been accorded in many cases is also true. But is the principle being adhered to generally? To this there can be but one answer, and that a negative one. The most that can be claimed is that the regulatory authorities are trying to maintain credit. Perhaps their effort could more fairly be characterized as one to prevent bankruptcy.

The moral of the situation is clear. The facts should be faced fearlessly and fairly. The investing public also has rights and can in the long run dictate terms within the limits of economic laws. If the commissions and regulatory bodies of the Government or the State, from considerations of policy or lack of power or support, have abandoned, or through the compelling force of events have been forced to disregard, their intent to remove the hazard of investment, the public is entitled to a frank admission of the fact. The corporations should not now be denied full relief from their extraordinary burdens and later on in normal times be limited again to a return restricted by the doctrine that commission control removes the hazard element.

To urge that the war is alone responsible for the situation justifies the conclusion that the hazards will be removed to a degree only, inversely proportionate to their severity. A fairer interpretation of the cause of the railroads under commission control during the past five years would be that the cutting of values and rates is an easier task than their upbuilding. Destructive influences can readily be set in motion in a moment by individuals. Constructive measures, on the other hand, involve coöperative effort over long periods of time.

Is it not likely that the avowed attempt to remove the hazard of investment has involved a task economically and psychologically impossible of achievement? The commissions and other regulatory bodies are indeed on trial.

Construction Plans Should Anticipate Contingency of Winter Work

ENGINEERS and contractors need to determine and appraise the factors which frost introduces in construction problems. It is seldom, north of forty-two, that one can be sure that work planned and undertaken can be completed during the season of no frost. Plans miscarry.

An example of good calculations gone wrong is furnished by the Dead River Dam, the construction of which is described in this issue. Had normal market conditions prevailed, the connecting railway to the dam site would have been completed in early summer, and before frost the bulk of the dam building would have been accomplished. War intervened, and actual building was not begun until frost had set in. Most of the construction had to be prosecuted in severe winter weather. Winter construction is a contingency always to be kept in mind. The engineer may well design his structure so that the dangers of winter work, should it become necessary, are minimized. The contractor should plan his operations in such a manner as will enable him quickly and at least cost to adapt his plant and his organization to the requirements of winter work. Means of winter construction need to be studied and their possibilities in the way of risk to the quality and appearance of work need to be determined. Data on the excess cost of winter construction should be collected.

Structures like the Dead River Dam, where zero weather concreting was carried on successfully all last winter, and like the Junction Dam, where hydraulic fill was put in at all temperatures above fifteen degrees below frost, are distinctly noteworthy because of the assurance they furnish of the comparatively slight risk from construction in winter. Extra precaution and often additional appliances are necessary of course, and these increase cost. They must increase cost very greatly, however, to equal the loss in accumulated interest and foregone profits resulting from delaying work until the next season.

Local Society the Fighting Unit

LOCAL societies are the fighting units in engineering society organization. The close acquaintanceship possible in a small organization favors effectiveness, while the public problems taken up touch closely the life of each member. In consequence there is a latent—and in some cases a present—virility about the local that should be capitalized by making it contribute to a national organization of all engineering forces.

With the purpose of strengthening the locals, the Cleveland Engineering Society early this year proposed that membership in a local society be made a prerequisite for membership in a national. Moreover, as further evidence of the close relationship it holds should exist between national and local bodies, the society has concluded an arrangement with the American Association of Engineers by which there are combination dues and entrance fees for the two organizations. The matter was explained by Mr. Drayer on page 217 of last week's issue of this journal.

The proposal made and the relationship effected call attention to the so-called Nashville plan, originating with Hunter McDonald, which proposes—presumably for exercising the civic functions proper to engineering societies—that engineering society organization be on a federal plan, with the Engineering Council as the national body. Societies in any one locality would be consolidated and have representation in a state society, while the state society in turn would be represented in the national body.

In the past five years, sentiment for strengthening the local has grown particularly strong in the Middle and the Far West. Mr. Drayer well analyzes the movement when he says that "the higher the standing of

the individual engineer in the community, the greater is his obligation both to the profession and to the community." That point of view has not been emphasized. In fact, no national engineering society professes, in its constitution, to accept any responsibility to the community. The present day is forcing a revision of traditional attitudes, and once the engineer's civic obligations and the pertinence of his participation through his organization in engineering questions of a public nature are clearly recognized, the need for strong local bodies is apparent.

While the immediate emphasis upon the need for strong local societies comes from the West, the thought is, of course, not new. One recalls that the present movement bears a strong resemblance to the Civic Scientific Alliance proposed by W. L. Saunders. That movement got so far as the drafting of a constitution and its submission by an organizing committee to the four national engineering societies and the American Chemical Society. In fact, the American Society of Mechanical Engineers approved of its formation. Before further steps could be taken, the plan for the Engineering Council was announced and Mr. Saunders advised that the proposed Alliance be held in abeyance until the council had an opportunity to prove that it was the proper instrument for centralizing the civic functions of the engineer. Under Mr. Saunders' plan, the engineers in any one state would organize and elect their delegates to a national body. As then proposed, it did not take cognizance of the local, but nevertheless was distinctly national in character. Later the proposed organization was spoken of as the Engineers' Civic Federation and the plan expanded by providing for local subsidiary bodies. The only value of this historical reference is to show that there are those in the East who can be counted on to support a matured plan for a national organization of what might be termed the civic forces of the profession.

Judged by the ideals of the proposed Engineers' Civic Federation, the Engineering Council so far has fallen short of the requirements. Thus far its affiliation extends only to the four national engineering societies, and its present plan includes the accession to membership of national bodies only. That plan is too narrow and must eventually give way. While it may be tolerated for the moment as a safe step in the development of the organization of the Engineering Council, we believe that the movements in the West will gain such headway as to force it to broaden its scope.

The coördination needed is not along technical lines. Technical committee work and technical functions generally can be carried on satisfactorily by the nationals without affiliation with the local bodies. But civic activity and the enlargement of the horizon of the engineer depend upon a national coöperative movement, participated in by broad men, giving a forum for receiving and disseminating views from every part of the land.

While such a civic movement pushed vigorously by the Engineering Council would not lack support, it would be materially strengthened if the national societies would see fit to insist upon membership in a local body as a prerequisite for membership. The proposal will come as a shock to the ultra-conservatives, but we see no direction in which it would affect detrimentally the standing of the larger bodies. They would still be free to grade their members as they chose and to select them with the utmost strictness. They could not elect a candidate unless he belonged to a local body—that would be the only limitation.

Any plan by which a national organization would be headed up into the Engineering Council would mean a readjustment of the present relationship to that body of the national engineering societies. Adjustments, however, are mere matters of detail, if a plan can be devised that will amalgamate for civic service the engineers of this country. The Cleveland movement, the Nashville plan and the federation proposed by Mr. Saunders are steps toward a much desired end.

"The Road to Berlin Begins in America"

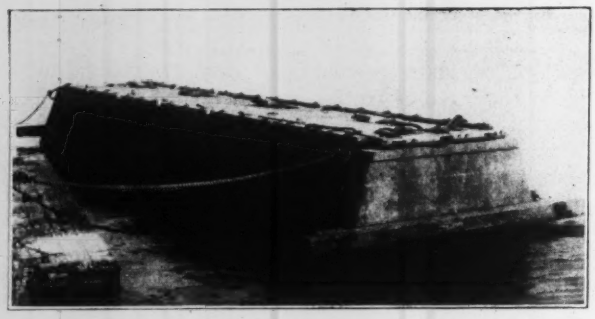
MOTOR-TRUCK advertising, with rare exceptions, has been used to emphasize the particular advantages of the make of truck advertised, some detail of its construction or some of its remarkable performances. We recall, however, that the Autocar Company and the Garford Motor Company have appreciated the necessity for building a good track for the truck to run on. One of the most striking evidences, however, that we have seen of a true appreciation of the position of the hard road itself in highway transportation is expressed in an advertisement of the White Company printed in the *Saturday Evening Post* of July 27. It is prefaced by the striking slogan used as the title for this note, "The Road to Berlin Begins in America," and points out that it is useless to manufacture materials if they cannot be transported. The advertisement correctly says, "Highways must relieve the railroads and highways *cannot* unless they are built to endure heavy trucking. Last winter more factories would have shut down for lack of coal, large cities would have suffered from food famine, and war exports would have been retarded if motor trucks had not been able to operate from country to city, from inland to seaboard. But, *all* of this assistance was *limited* by the scarcity of good roads."

We wish that more manufacturers—yes, and more officials in Washington—would take the same broad point of view that is taken by the White Company in this advertisement. What use to build trucks, what use to produce food or manufactured articles, unless they can be transported? For our railways the government has a denfinite policy of increasing facilities; on the conversion of industries from a peace to a war basis Washington's ideas are most definite; on the restriction of luxuries, the rationing of foodstuffs, on forcing men into important work there are clearly defined policies. On highways, strictly a war essential, there is confusion. Washington blows hot and blows cold in almost the same breath. It declares in one moment that the investment in highways must not be lost and that highways are a necessary part of the transportation system. The next minute it passes priority order No. 2, prohibits the use of certain bituminous materials for roadbuilding (though plentiful supplies are available) and threatens the ruin of contractors by raising railroad rates on roadbuilding materials from 50 to 200 or 300%. Would that there were more straight thinking, such as evidenced in this advertisement, in official Washington.

Concrete Caisson of New Type Used in Breakwater

Trapezoidal Shape Adopted for Economy—Caissons Launched, Sunk in Place and Filled to Carry Superstructure of Monolithic Concrete

HOLLOW reinforced-concrete caissons of trapezoidal section—that is, having sloping sides—are being used for the south breakwater now under construction at Racine, Wis. They are launched on inclined ways and after being floated into position are sunk upon a prepared bed of broken stone. Upon them is a superstructure of monolithic concrete. Similar caissons, but of rectangular section—with vertical sides—have been used for the north breakwater at Racine and also at



HOLLOW CONCRETE CAISSON HAS TEMPORARY DECK FOR TOWING TO BREAKWATER 25 MILES AWAY

Milwaukee, Sheboygan, Manitowoc and Algoma, all ports on the west shore of Lake Michigan.

The trapezoidal caissons for the work at Racine were adopted primarily to secure greater economy in construction and increased stability. The principal saving is due to the reduced section of superstructure, as compared with that of the rectangular section formerly used, the total reduction amounting to $25 or more per linear foot of breakwater.

All the caissons are 54 ft. long, 10 ft. wide on top, with sides sloping 3 on 1. Each is divided into compartments by three 10-in. cross walls. They are of three heights: 21 ft. 3 in., 18 ft. 3 in., and 15 ft. 3 in., with bottom widths of 24 ft., 22 ft. and 20 ft., respectively. Those of the smaller sizes are built in forms made by cutting 3 ft. from the bottoms of the forms for the next larger size. In the largest caissons the side walls are 12 in. thick at the top and 16 in. at the bottom, while the end walls are 16 in. and the bottoms 24 in. thick. Concrete is proportioned 1:2:4, with 1-in. broken stone for the coarse aggregate. Double reinforcement is provided in the sides, ends and cross walls.

The reinforcing steel for the bottom is suspended from the cores and supported by small concrete briquets laid on the plank bottom. The reinforcement for the sides, ends and cross walls is assembled over templets on the floor of the wharf and built up into mats which are hoisted and placed by a locomotive crane, being then secured in position with steel spreaders and wires.

The bottom of the form is 3-in. plank placed on blocking. This planking remains as part of the caisson, being anchored to the concrete by ⅜-in. wire spikes 7 in. long. The core forms are supported on steel knees which rest on the plank bottom. Their tapering ends are made in halves so that by unbolting the vertical center joint they can be taken apart for removal. The outside forms are held by trussed strongbacks of 12 x 18-in. timbers, connected by the rods beneath the bottom and above the top of the caisson.

Concreting is done in one continuous operation, the entire form being completed before this is begun. The concrete is allowed to set for 10 days before the launching. These caissons are made at Milwaukee, Wis., by hired labor at a plant built specially for the purpose by the United States Government. This plant is equipped with a locomotive crane, a 1-yd. mixer with side loader, sand and stone bins for gravity charging, and sheds for storing steel and cement. The locomotive crane is used for handling forms, placing steel reinforcement and pouring concrete.

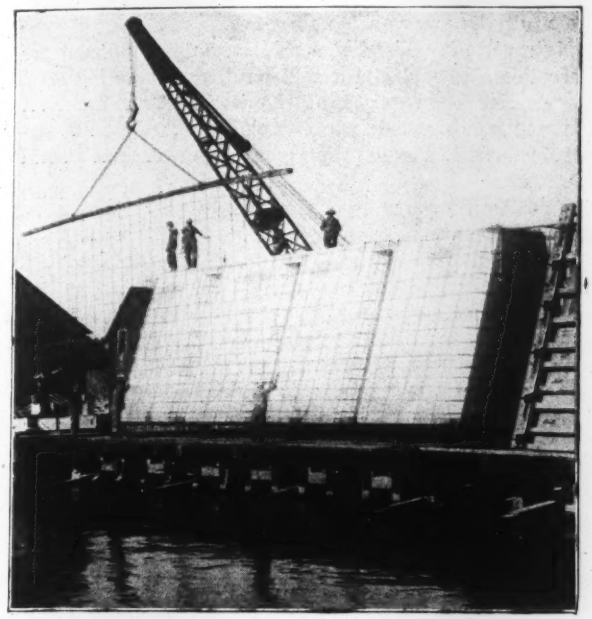
The caissons are launched from ways having a slope of 1 on 8, according to the method described on p. 287, of this issue. These extend from about 3 ft. above water to about 20 ft. below the water surface, so that the largest caissons float free of their supporting shoes without plunging. This elimination of plunging permits the minimum amount of reinforcement to be used and makes it unnecessary to place temporary decks for launching. With the two launch ways at this plant it is possible to build and launch a caisson every six to nine days, depending upon the size. The launching

OUTER AND INNER FORMS OF HOLLOW CONCRETE CAISSON FOR BREAKWATER

weight of a caisson of the largest size is a little more than 500 tons.

After being launched, the caissons are stored generally by sinking them with water ballast so as to rest on the lake bottom in such depth of water that their tops are above the surface. When caissons are to be used they are freed of water by siphoning and then provided with temporary decks and towing rigs. They are towed to Racine, a distance of about 25 miles, and are delivered to the contractor.

The temporary decks are 3 in. thick, and are composed of 2-in. tongued-and-grooved plank and 1-in. matched lumber, with a layer of painted canvas between the two courses. Each caisson has four sections of deck, secured by anchor bolts embedded in the tops of the walls, and made water-tight by gaskets formed of ½-in. water hose. The joints between the sections are calked.

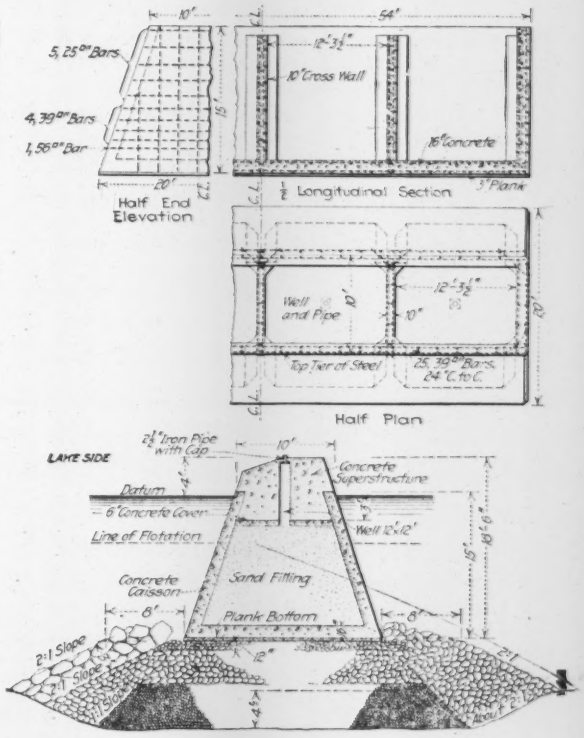


LOCOMOTIVE CRANE PLACES REINFORCEMENT FOR CAISSON. LAUNCHING WAYS UNDER THE DECK

The decks are removed by the contractor and are returned to Milwaukee on a small scow taken with each tow for that purpose. The towing speed is 2½ to 3 miles per hour, with two caissons towed on each trip.

A bed of broken stone forms the foundation of the breakwater. For this a trench was dredged 4 ft. in the sand, with a bottom width of about 40 ft., the slopes being approximately 1 on 2. This was filled with 4 ft. of flux stone deposited from dump scows. The upper part of the foundation bed is of 50-lb. to 200-lb. stone, except that to facilitate leveling a thickness of about 1 ft. at the top consists of stone of 10-lb. to 50-lb. size. The surface of the stone fill is leveled by divers to provide a uniform bearing for the entire base area of the caisson. A small amount of 500-lb. to 1-ton stone is placed on the lake side of the foundation to keep wave action from disturbing the smaller stone.

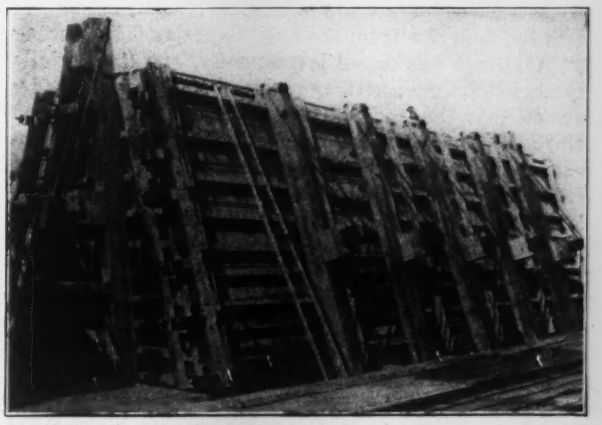
Caissons are floated to place and then sunk upon the stone foundation by filling with water, either through siphons or by pumps. Sand or 50-lb. to 200-lb. stone is



BREAKWATER OF HOLLOW CONCRETE CAISSONS HAS BROKEN-STONE BED AND CONCRETE TOP

used to fill the caissons to within 4 ft. of the top. This is sealed or covered with a 6-in. layer of lean concrete, 1:5:10, placed in the dry, in order to keep the filling from being washed out by wave action before the superstructure is built.

The superstructure is a monolithic cap of concrete extending from the 6-in. concrete cover to a height of 3½ ft. above the top of the caissons. Concrete of 1:2:4 mix, made with 2½-in. broken stone, is placed in the dry, timber forms being used for the upper 3½ ft. Where sand filling is used, a well 12 in. square is formed above each compartment, extending from the top of the fill to within 6 in. of the top of the superstructure. A 2½-in. pipe, with cap, extends through this 6-in. cover. The



FORMS FOR HOLLOW CONCRETE CAISSONS FOR BREAKWATER AT RACINE, WISCONSIN

pipe and well permit of taking soundings in the future to determine if there has been loss of sand through cracks in the caissons, such as might develop from uneven settlement of the foundation or from other causes. In case of serious loss of sand filling it is purposed to fill the space with grout poured through the pipe. The top of the superstructure or finished breakwater is 4 ft. above United States datum for Lake Michigan or about 5 ft. above mean lake level.

Material for a 54-ft. length of breakwater, with caisson 54 ft. long, 20 ft. wide on the bottom and 15 ft. deep, is as follows: Concrete in caisson, 151 yd.; concrete in superstructure, 103.69 yd.; concrete cover, 8.8 yd.; sand filling, 238 yd.; plank bottom, 3240 ft. b.m., reinforcing steel, 10,287 lb.; bottom spikes, 97 lb.; rip rap, 40 tons. The length of this concrete caisson breakwater is 1512 ft., of which 702 ft. remain to be built this season. The foundation work, sinking and filling the caissons and building the concrete superstructure are being done by the Greiling Bros. Co., Green Bay, Wis., with Robert Moser as local superintendent. The caissons are built by day labor and under supervision of the engineers of the United States Government, as noted above. All the work is under the direction of J. A. B. Tompkins, district engineer, United States Engineer Office, Milwaukee, Wis. E. M. Nisen is United States assistant engineer, and A. I. Reed is United States inspecting engineer.

Lukewarm Concrete Enough Precaution for Zero Weather Dam Work

Perfect Bond and Sound Concrete Secured by Placing Fifty-Degree Mixture on Frozen Surfaces—Concreting Kept Up in Heavy Frosts

BLINDING snow storms were the only weather conditions which stopped concreting last winter on the Dead River Dam in northern Michigan. At other times work progressed steadily during a period of three months when the mercury sank below zero more often than it rose above freezing. Two boilers, a steam coil in the sand bin and another in the water tank, and a force pump, with hose line, connected to the hot-water tank were the only frost-fighting apparatus that was employed.

Warm concrete deposited on the frozen top of the previous day's work took out the frost and made a perfect bond even when the frost layer was 3 in. thick.

The dam, on Dead River northeast of Negaunee, Mich., is a part of a new 10,000-hp. hydro-electric development for the Cleveland Cliffs Iron Co. It is 400 ft. long, of gravity section and contains 17,000 cu.yd. of concrete. The foundation and one abutment are ledge rock; the other abutment is a sand hill into which the masonry penetrates and which is guarded from scour by sand-filled timber cribbing. The retaining wall top is at Elevation 1201 and the spillway crest at Elevation 1197.

Construction of a 2½-mile railway was necessary to reach the dam site from the Lake Superior & Ishpeming Ry. Contract was closed last summer, and it was fully expected that construction would be well under way by July so that the bulk of the concrete could be placed before cold weather set in. Unfortunately, this program was upset by delays in obtaining track materials. With the very best effort the railway could not be completed before Oct. 1, 1917, and it was not possible to begin concreting for another month. This left the greater volume to be placed during December, January and February. Lake Superior winters are cold always, and last winter is nemorable as a winter of extraordinary cold everywhere. The construction prospect was not alluring. Yet, as already stated, cold weather was not permitted to stop construction. Even during the 30° below zero frosts of January concreting progressed steadily. Sometimes the gang would be snowed in for a day or two, but severe frost alone was regarded scornfully by the working force.

Naturally, it will be thought, exceptional precautions were taken to make this cold weather concreting safe. Herein lies the interest of the work. Only the most commonplace methods were employed. A little hot water for surface thawing and good warm concrete turned the trick.

Two steam boilers supplying coils in material bins and in the water tank heated the sand and water. A tower 135 ft. high and chutes with a maximum run of perhaps 200 ft. distributed the concrete. No especial precautions in chuting were employed to keep the concrete warm. It went into the forms, according to thermometer records kept during the very coldest weather, at temperatures varying from 40° to 65° and averaging 50 degrees.

It was planned at first to employ some means of heating the concrete in the forms. The sections concreted being too large for easy housing, canvas was spread over the concrete and live steam was turned underneath

CONCRETING ON BUILDING OF DEAD RIVER DAM WAS STOPPED ONLY DURING SNOWSTORMS

through jets. This was not a success. Except in the immediate vicinity of the jets the concrete froze. Finally all notion of keeping the mass from freezing on top was discarded, and after each day's work the concrete was left exposed to the elements overnight, but the precaution was taken to bulkhead the work in such a way that a day's run of concrete would fill up at least a 5-ft. vertical lift.

After being exposed overnight to a heavy frost, say 20° below zero, the frozen layer on top and sides would be about 2 in. thick. It was planned at first to remove the frozen top by picking. This proved laborious and delayed the work. Finally it was decided to take the chance of securing a good bond by merely thawing off the top skin of ice and frozen laitance and then depositing the fresh layer.

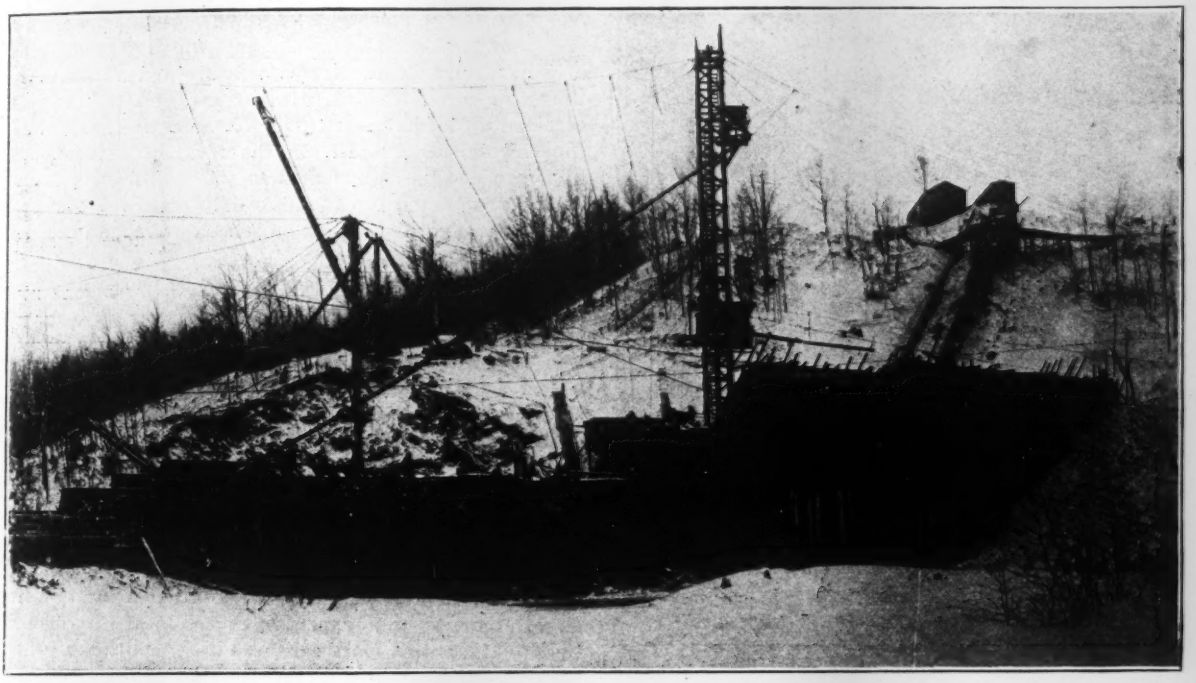
For removing the frozen top skin the most successful method was hosing with hot water. A small feed pump connected with the hot-water tank was used to give water pressure to any part of the work. The hot water proved to be much more effective than live steam. It was found that by running water over the frozen surface and letting it stand a few minutes all surface frosting was removed. The fresh concrete was then placed.

Observations upon the action of placing fresh warm concrete upon the frozen layer of the previous day's pouring showed that when the concrete placed was at a temperature of about 50°, the warm mass completely thawed the frozen layer and a good bond resulted.

On July 1 water stood back of the dam at El. 1170 and all concrete placed in the extremely cold weather was entirely covered. There were absolutely no signs of leaks from horizontal or vertical joints in the concrete that was placed in the extremely cold weather.

Steel forms were used, and it was found that frost penetrated the sides from 2 to 3 in. Incidentally, where 2-in. plank forms were used, in one or two places there was no freezing on the sides. It was anticipated that the outer frozen surface might slough off and cause a rough looking job, but such was not the result when the concrete thawed in the spring. When the concrete had been placed in the very coldest weather a scaling of about ¼ in. occurred, but not enough of it to spoil the appearance of the surface.

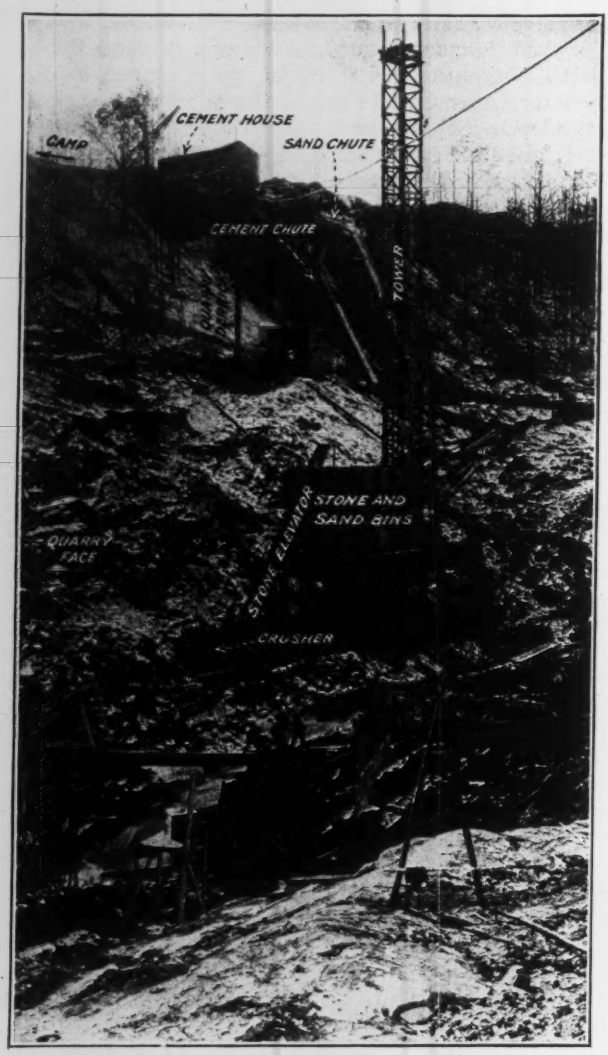
Owing to its isolated position and the severe winter climate, the Dead River Dam had to be largely a self-contained job. The men lived there. All materials were obtained at the site that could be thus procured. These requirements called for camp buildings, quarries and sand pits, with all the needed working equipment, besides the usual construction plant.



MATERIALS HANDLING SIMPLIFIED BY HILLSIDE LOCATION OF PLANT

About two miles above the new dam the iron company has a 1000-hp. hydro-electric plant. From here a 2200-volt transmission line was carried to the new work, and all construction plant was operated either directly by electricity or by air supplied by an electrically driven 22 x 14 x 18-in. air compressor. The compressor supplied air for drilling at the quarry, for the mixer engine, and for four hoisting engines. One feature was a camp kitchen provided with electric cooking ranges. Steam was used only for heating concrete materials; it was furnished by two small boilers.

The construction outfit was located largely on the south bank of the river, as indicated by the pictures. At the camp site, which was the very top of the hill, the elevation is 1300. This hill breaks off at a slope of about 40° down to El. 1200, which is about dam top height and where a rock bench about 75 ft. wide is struck. On the stream side this bench pitches nearly vertical to the river level. The mixer plant and dis-



DISTRIBUTING TOWER AND TWO DERRICKS PLACED CONCRETE AND PLUM STONES

tributing tower were located at the river level on the downstream side of the dam and close up to the face of the ledge. Chutes from the distributing tower reached to both ends of the dam. The only plant of size along the dam was two derricks for handling plum stones.

Stone for crushing and for plums was quarried from the rock cliff just behind the mixer plant. A crusher, with a bucket elevator to the stone bin, was set on the quarry bottom and was supplied by a derrick from the bench above. On top of the hill was a gravel pit. Here in warm weather a clamshell excavator loaded the sand into a hopper which chuted into a receiving hopper on the ledge level below. From here small cars took the sand to the bin of the mixer plant. In winter the clamshell delivered too many frozen lumps, and shovelers and a car line to the hill-top hopper were substituted. Cement came in cars to the cement house on the top of the hill, and from here the bags were delivered to the mixer through a covered chute.

The construction of the plant and the methods of work, aside from the requirements of local development of crushed rock, plum stones and sand, and the electrical operation of all equipment and winter concreting, had no unusual features. O. D. McClure, chief mechanical engineer for the Cleveland Cliffs Iron Co., was in full charge of design and construction of the project. The Foundation Co., New York and Chicago, were contractors for the dam, under the direction of F. W. Adgate, western manager, Chicago. L. C. Jacobs was superintendent in charge for Mr. Adgate.

Gas Troubles Delay California Tunnel

DRIVING the 8700-ft. tunnel on the Marin Municipal Water project, described in *Engineering News-Record* of Nov. 8, 1917, p. 884, was hampered by the presence of inflammable gas which flowed from drill holes under considerable pressure and which sometimes appeared in quantities after a blast. On one occasion work was discontinued for an entire week while the flow burned steadily in the form of a giant jet. The men became accustomed to the gas, however, and means were found for handling it in such way that the work was completed almost on schedule time despite the inconvenience.

The troublesome vapor, believed to be marsh gas, was first encountered about 3000 ft. from the east portal in a hard diabase rock. For its entire length the tunnel was driven through rock of igneous formation, chiefly a succession of black and green serpentine with occasional ledges of diabase. Later on, gas was encountered in even greater quantities on the west face, about 1000 ft. from the point where it was first met in the east heading. The gas would be ignited by the blasts and when new pockets were opened up the burning continued until they were exhausted.

In the first experience with the gas, some of the men when they returned to work after a blast, were slightly burned in an explosion caused by the uncovered lights. After this more care was used, and when going back to the heading after a blast the men cleared the tunnel of gas by fastening a carbide lamp to a long stick and holding it close to the roof of the tunnel, the men meanwhile keeping close to the floor. In this way the gas was caused to explode, though not with great violence, as the flame would spread along the roof of the tunnel and over the heads of the men. The gas was sometimes ignited and allowed to burn as it emerged from a drilled hole during the process of drilling.

After the first accident two others occurred, one when a timekeeper caused an explosion by climbing up on the rock pile without first testing the air, and another when a dome in the roof collected a considerable amount of gas, the flame from which shot downward on the men instead of along the roof in the usual way. The gas did not seem injurious when inhaled, so no gas masks were necessary at any stage of the work. But when it burned fiercely the oxygen in the tunnel was exhausted, the heat became very oppressive and under these conditions the men could not work.

The work is being done under the direction of M. M. O'Shaughnessy. A. R. Baker is resident engineer in charge.

Keeping Land Drainage Channels Clear of Growth and Debris in the South

Experiences in Removal of Willow and Other Sprouts and Maintaining Cross-Section in Two Drainage Districts—Cost Data Given—Force Account Considered Better Than Contract Work

By Albert S. Fry
Morgan Engineering Co., Memphis, Tenn.

IF DRAINAGE channels are to give the greatest return upon the capital invested they must be maintained in a free and unobstructed condition so that their discharge capacities will continue undiminished. The regimen of the ordinary drainage channel is that soon after it is excavated willow, cottonwood and other sprouts spring up along the berms and waste banks and in the channel itself. Before the banks of the channel have stood for a sufficient time to weather down to their natural slopes, the material slides, caves and is washed into the channel. To some extent, the growth on the berms and waste banks helps to prevent washing and sliding of the material into the channel. But the growth in the channel itself is extremely undesirable as an adjunct to an efficient waterway.

In carrying out maintenance work, not only should the growth be removed but all débris, such as logs, drift, fences, objectionable floodgates and other obstructions to the flow should be removed. Where the growth is not too large, it should be removed root and branch. Where the growth is of such a size that it cannot be readily pulled out, the sprouts should be cut off at the roots below the surface of the ground with a mattock, an axe or a machete. In either case the sprout is removed so that no stub remains projecting above the ground. Some few rootlets will be left in the ground even after the sprouts are pulled out, but experience shows that the succeeding season's growth is less from these rootlets than where a stub is left protruding above the surface.

Growth Should Be Pulled While Sap Is Up

The proper time to pull growth is while the sap is up, for if the sprouts are pulled when the sap is down the pieces of roots broken off below the surface spring up much more readily the next season. The sap is up in the South from about the first of May until the early part of September. The month of August has proved to be the best time for removing growth.

On newly constructed work there are always in the ditches a considerable number of small bars and minor slides that are the result of the natural agents of weathering and which constitute deterioration that must be expected with the present methods of construction of ditches by floating dipper dredges. In planning a system of drainage channels, it is good practice to construct the ditches a foot or two deeper than necessary for good drainage, considering that the drainage value of the lowest foot of channel will soon be lost through natural deterioration. It is not necessary, then, to remove bars unless they are a foot or more above grade. Where there are only a few bars in a channel a low-water channel may be opened through them to prevent ponding of water behind the bars. Where a ditch deteriorates throughout a considerable length and more than a foot above grade, the cost of opening a low-water channel would be quite heavy. Each individual case must be considered to determine the work to be done.

In far too many drainage systems these fundamental principles have gone unheeded, with the result that the ditches have deteriorated so that proper drainage is not obtained. Two of the largest drainage districts in the South, however, have been keenly awake to the necessity of maintenance and have carried forward extensive operations to prevent deteriorating influences from interfering with the best drainage. These districts are Grassy Lake and Tyronza Drainage District No. 9, Mississippi County, Arkansas, and the Bogue Phalia Drainage District, Washington County, Mississippi. In both districts, the Morgan Engineering Co. of Memphis has directed all the maintenance operations.

There are about 300 miles of channels in Drainage District No. 9. Excavation was started in 1912, and by the summer of 1915 there were about 40 miles of ditches which had been dug for two years or a few months more. They had thus passed through from two to three growing seasons during which growth had sprung up to such an extent that its removal was considered necessary. Practically all of these ditches were 14 ft. wide on the bottom with bank slopes of ½ to 1 or 1 to 1 and an average depth of about eight feet.

To determine the condition of all of the ditches excavated up to that time an inspector walked out each ditch and made notes concerning the size and character of the growth and obstructions in the channels. For the most part the growth consisted of young willows and cottonwoods up to 2½ in. in diameter. The number of sprouts ran up to as many as 450 per 100 ft. of ditch, with the greater part ranging from 20 to 50 sprouts per station.

Establishing Reasonable Contract Prices

Very few contracts had previously been let in this section of the country for removing growth from ditches. To establish a basis for reasonable prices for letting the work, typical lengths of ditches were selected and cleared with a crew consisting of a foreman and five or six negroes. This experimental work was undertaken in the early part of July at a time when negro labor is largely engaged on working the cotton crop and is not easily obtained for other work. It was recognized that better and cheaper labor would be available a few weeks later after the cotton was laid by. It was necessary to do the test clearing with a crew of only five or six negroes, whereas the economical size of a crew is about twice this number to one foreman. Notwithstanding the somewhat adverse labor conditions, the results of the experiment showed that the growth could

be cleared from the ditches at costs varying from $25 to $50 per mile.

Following the experimental work, contracts were let for about 40 miles of ditches at prices ranging from $27.50 to $57 per mile. More than half of the work was let for $50 per mile. The work was done by local contractors, some of whom were planters with land in the district whose negro hands had little to do after the cotton had been laid by.

By the summer of 1916, the greater part of the channels in the district had been excavated and it was necessary to inspect again the ditches and obtain information from which to determine the maintenance work necessary. Each inspector, in addition to having the maps and profiles used for the location of the work in the field, was supplied with a hand level with which to determine whether or not a ditch had filled in above the grade line of the original design. Special detailed instructions were issued to the inspectors outlining the points to be covered in their reports. These points were: (1) willows and other tree growth; (2) fills and bars; (3) fallen trees; (4) drifts, and (5) fences and flood gates.

Under the first classification, the size and number of willows, cottonwoods and other growth were noted. This was determined by counting the number of each sized sprout within a typical section of ditch, usually about 200 ft. long. Separate notes were made for growth in the channel, on the berms, and on the waste banks. Where sprouts were growing from stumps on the berms, the number of stumps per 100 ft. was recorded together with the height, size and number of sprouts on each stump.

Fills and Bars Classified

The general dimensions of all earth deposited in the channels of the ditches were noted. The approximate height above grade was determined with the hand level. Fills and bars were classified as nearly as possible according to three main causes that produced them: (a) from material deposited by the cutting back of local drains entering through openings in the waste banks; (b) from material washing down from the slopes of the ditch itself, and (c) by slides in the banks of the ditch and, in some cases, in the waste banks also. Whether or not a bar completely stopped the channel so that ponding occurred and the extent of any ponding were also recorded.

In the case of fallen trees the position of the tree with respect to the channel was given, and an estimate of the percentage of the waterway that was blocked was made. The character of all drift was noted as well as the agencies that caused the drift. These are usually bars, fallen trees, fences or floodgates, or improperly constructed bridges. The location and construction of all fences built across the bottom of the ditches were set down. Special attention was given to flood and water gates to determine whether they were of such construction that they would operate properly in times of high water and whether these gates had in the past been the cause of the collection of drift or the formation of bars.

Inspection of the channels showed that most of the fills and bars were not serious obstructions, and it was thought best to defer the removal of the filled-in material for another year, by which time the ditches would have passed through another winter and another high water—both of which factors tend to bring the ditch banks into a condition of stability—so that there would be little likelihood of further trouble from slides. A selected number of bars were removed by shooting with dynamite, for experimental purposes, for determining the cost and effectiveness of this method.

The inspection of channels further showed that about 95 miles of ditch should be cleared of growth and débris. About 72 miles of this work was contracted to be done at a price of $35 per mile, 20 miles were let at $40 and the remaining 3 miles at $45 per mile.

Specifications for the Work

The following paragraphs from the specifications for removing growth and débris indicate the manner in which the work was required to be done:

1. Description—The work to be performed under these specifications shall include the clearing of all tree growth from the excavated section of channels and from a strip 12 ft. wide measured from the top edge of the ditch, the removal from the channel section of all logs, stumps, trees, tree-tops, drift, fences, floodgates, and débris of all kinds, and shall include all other incidental operations necessary to carrying out the purpose for which the work is undertaken.

2. Character of Work—All willows, cottonwoods or other young sprouts under 2 in. in diameter shall be pulled out with their roots. All such growth exceeding 2 in. in diameter shall be cut off at the roots 3 in. under the surface of the ground. All obstructions of whatever nature now in the channel of the ditch shall be removed. Where fences extend across the channel, or a portion of the channel, that portion of the fence within the limits of the excavated section shall be carefully removed to the side of the ditch. Floodgates shall be removed from all channels unless instructions to the contrary are given by the engineer.

3. Disposal of Material—The contractor shall pile and burn all growth and obstructions cleared from the channel of the ditch. The contractor may, however, place all material that is removed entirely over the waste bank instead of burning it, provided by so doing no damage is done to lands adjacent to right-of-way.

It will be noticed that a diameter of 2 in. was used as the maximum size of sprout to be pulled. This was selected after tests had been made in the field which showed that sprouts over 2 in. in diameter could not be pulled without the use of mechanical aids, and that when growing in dry ground the sprouts would break off before they could be pulled out. After two seasons' operation with 2 in. as the maximum diameter to be pulled, it is now believed that this is too large and that a smaller diameter should be used.

Work in the Bogue Phalia Drainage District

In the Bogue Phalia District there are about 180 miles of drainage channels. The greater part of the excavation work was started about the first part of 1915. By the summer of 1916 many of the channels were passing through their second growing season. An examination of each ditch along the same lines as those

described for Drainage District No. 9 disclosed the same general conditions.

Some experimental work was done in this district on the use of chemical destroyers for killing trees, sprouts and coco grass. In general, the results of this work were unsatisfactory. In the case of trees, it was necessary to hack well around the tree in order to apply the chemical. This alone is usually sufficient to kill it.

The removing of growth from the ditches was done by contract and by force account. The latter proved the more satisfactory.

The force-account work was carried on by a crew consisting of a white foreman, nine negro laborers and a cook, all working directly under the resident engineer. The party lived in tents and ordinarily camped near the ditch upon which work was being done. Due to the short duration of the work, only temporary cooking utensils were required so that only a small expense was incurred for that part of the outfit.

Variety of Tools Used

Machetes and brush axes were used for cutting all willows and other growths too large for pulling. A cross-cut saw, sledge, wedges and axes were used for cutting up trees and débris so that they could be removed from the ditches. Cant hooks were provided for lifting the heavier logs from the ditches. Cotton gloves were furnished the men to protect their hands. A pair of these gloves lasted about a week. The gloves were found quite useful in preventing sore hands, although in some cases the men's hands became sore even with gloves.

In clearing a channel of ordinary size, the party was scattered so that there would be little interference among the workers. The men were, however, kept close enough together so that they could assist one another in removing drift too large for one man to handle. It was found that for the most efficient operation the party should not stop its work of willow pulling and drift removing in order to saw and cut up trees which were in the channel and which had to be sawed and cut before they could be removed. This work was all left for a return trip.

All except two of the men were ordinarily engaged on pulling the willows and sprouts and removing the small drift. The other two men followed behind the rest of the party and cut the willows which were too large to be pulled and cut the grass and weeds in the bottoms of the ditches. For cutting the sprouts, the machete has proved to be the most useful tool. Willows that could not be pulled by one man were usually left to be cut, for it was uneconomical for more than one man to pull on one willow. Except on large ditches, the sprouts were thrown out on the waste bank at the time they were pulled, the earth adhering to the roots giving weight so that they could be easily thrown.

In the ditches of large size, where the distance to the waste bank was too great for throwing, the sprouts were either piled and burned or carried out of the ditch. No limiting size of sprout for pulling was used, for it was found that the size that could be pulled varied according to the condition of the soil at the time of clearing. In wet ground, sprouts of quite large size could be pulled without difficulty, while in dry, hard earth even small sprouts were not easily pulled and often broke off near the surface of the ground.

The costs of the work done by the force account party are given in Table I (see next page). Note that the cost of clearing three miles of Ditch 12 was $36.73 per mile. This ditch was very wide and deep, the base being from 80 to 120 ft. and the depth about 18 ft., which made the cost higher than for a ditch of ordinary size. The 14-ft. bottom ditches of ordinary size were cleared at costs from a little more than $13 to slightly less than $21 per mile, except in the case of Ditch 24, which cost $35 a mile. This high cost was due largely to the fact that camp was not pitched immediately in the vicinity of the work on this ditch, and it was necessary for the party to walk long distances in order to reach the work. This reduced the actual time that could be put in working and the cost was correspondingly increased.

The cost of contract work is given in Table II. A comparison of this table with Table I furnishes information on the relative merits of the two methods of operation on this particular job. The range of the contract prices is from $15 to $25 per mile. It will be noticed that the length of ditches cleared was short. This is due to the fact that the work was done by negroes who lived along the ditches and who could only contract to clear small stretches of ditch. This condition, however, operated for a low contract price.

The prices in Tables I and II are lower than the costs in Drainage District No. 9. The difference is partly due to the fact that the berms were not cleared on the Bogue Phalia work but were included on the District No. 9 work. Labor conditions were also more favorable on the Bogue Phalia work.

Comparisons of Costs of Two Methods

A comparison of costs for the force-account and contract work shows little in favor of either method. The growth on the force-account work was somewhat heavier than on the contract ditches, so that there is a small margin in favor of the force-account work. But aside from actual costs, there are other considerations that make the force-account work preferable. Better work can be obtained. With contract work, unless inspection is very rigid, it is difficult to make the contractor pull all the growth that should be pulled. Although the contractor is required by the specifications to pull all sprouts of one-man size and cut the remainder below the ground, it is not at all unusual for the ordinary contractor on this class of work to cut willows which could be pulled easily, since it is much easier to cut than to pull them.

When the work is done by force account, the foreman has no object in cutting any of the willows which can be pulled and the ditch is left in a better condition as a result. Where the willows are cut off they spring up again the following season but where they are pulled out there is nothing left to promote further growth except some tiny rootlets. The fewer sprouts that are left in the ditch cut off under the ground the less the thickness of the next season's growth is likely to be. It appears, then, that on force-account work, fewer willows that could be pulled would be cut off under the surface, and hence the next season's growth would

TABLE I. DITCH CLEARING WORK DONE BY FORCE ACCOUNT

Ditch No.	Miles From	Miles To	Length Cleared, Miles	Average Diameter of Sprouts, In.	Number of Sprouts per Station	Obstructions in Channel	Dimensions of Ditch: Base Width, Ft.	Dimensions of Ditch: Side Slopes	Dimensions of Ditch: Average Depth, Ft.	Growing Seasons since Construction	Cost per Mile
12	0	1	1	¾	200–400	1 small drift	80	2:1	18	2	$36 73
	1	3	2	¾	200–400	1 large drift	120	1½:1	18	2	36 73
14	0	1	1	½	50–100	.....	14	½:1	6	2	15 28
	1	4	3	¾	150–200	3 trees	14	½:1	8	2	15 28
	4	5	1	¼	20	1 log, and some debris	14	½:1	8	2	15 28
16	0	3	3	½–¾	150–200	9 trees, debris, 1stump	14	½:1	8	2	20 83
	3	4	1	½	50–100	.....	14	½:1	8	2	20 83
17	0	3	3	½–¾	200–500	2 logs	14	½:1	8	2	20 75
	3	4	1	½–¾	25–50	.....	14	½:1	8	2	23 75
18	1	4.2	3.2	¾	200–400	Some debris	14	½:1	8	2	13 12
24	0	1	1	¾	50–200	.....	14	½:1	7	2	35 00
	1	2	1	¾	400–500	.....	14	½:1	8	2	35 00
	2	4	2	¾	50–200	1 tree	14	½:1	8	2	35 00

The costs per mile include labor, moving camp, groceries, cook's salary, and depreciation on camp equipment and tools, together with all incidental expenses. Engineering supervision is not included, as a part of the cost for this expense occurs alike on force account or contract work. The wages paid on this work were: Foreman $3 per day, laborers boarding in camp $1 per day, and laborers boarding themselves $1.25 and $1.50 per day.

in all probability be less, which would mean that the cost of clearing would be lower next season.

Correlated with the last-mentioned advantage of force-account work is the fact that the actual engineering supervision and inspection needed is considerably less than on contract work. In order to secure good work on contract jobs of this kind, it is usually necessary to keep a very close watch on the work and this, of course, requires considerable time of the engineer.

Still another factor in favor of force-account maintenance work is that on a contract basis per mile the variations in the condition of different portions of the ditches do not receive proper weight and consideration. A section of ditch that has little growth is paid for on the same basis as an adjoining section that may be heavily overgrown. It might be thought that the contract price would represent average conditions for a contract, but practically this does not work out. The contract price inclines almost always toward the portions that are more thickly grown up. Where the work is done by force account, these variations are automatically adjusted by the time required to clear each part of the work, which must vary according to the heaviness of the growth.

The results of the work in the Bogue Phalia District point therefore to lower cost, a better degree of work, a lower future cost, lower costs for engineering supervision and a proper consideration of the variations in growth along a ditch, if the work is done by means of a force-account party than if done by contract.

The district, some time previous to the 1916 maintenance work, furnished wire and fenced a portion of the main drainage channel of the district to determine whether or not it was profitable to keep down the growth along the channel by pasturing stock within the fenced area. The fence was built so that a strip averaging about 250 ft. in width was left between the water's edge and the fence. This method of keeping down the growth did not prove a success, because a sufficient number of animals could not be kept on the pasture, a condition brought about largely because pasture land was plentiful in relation to the number of head of stock to be pastured. The condition of the banks of the stream for practically the entire distance pastured were found to be very similar to the banks of the portions of the stream which were not fenced. There was one exception to this in the case of a small tract which was used for grazing mules. In this tract the mules kept down the weeds and brush with the exception of the willows. Mules do not ordinarily eat willow sprouts unless other grazing is scarce. Cattle, however, will eat the willows.

In country that has been developed long, where pasture land is scarce, and where a sufficient number of stock can be pastured upon each acre of land, it is both successful and economical to use this method of keeping down growth. In new country, as the Bogue Phalia District, pasturing is not likely to be a success.

TABLE II. DITCH CLEARING WORK DONE BY CONTRACT

Ditch No.	Miles From	Miles To	Length Cleared, Miles	Average Diameter of Sprouts, In.	Number of Sprouts per Station	Obstructions in Channel	Dimensions of Ditch: Base Width, Ft.	Dimensions of Ditch: Side Slopes	Dimensions of Ditch: Average Depth, Ft.	Growing Seasons since Construction	Cost per Mile
4	0	1.9	1.9	¼	500–750	2 large drifts and debris	25	1:1	16	3	$25
5	0	2	2	¼–⅜	50–400	Debris and 1 tree	14	½:1	8	2	15
7	0	1	1	¼	100–200	.....	14	½:1	7	2	20
18	0	1	1	½–⅝	200–400	3 trees	14	½:1	8	2	25
27	0	1	1.5	¼	100–200	3 trees, 1 log, debris	14	½:1	8	2	20
	3	5	2	¼	100–150	.....	14	½:1	9	2	20
29	0	1	1	¼	100	.....	14	½:1	8	2	20

Spruce Preferable for Wood Airplane Parts

Spruce is preferred for the wooden portions of airplanes, both because it is the toughest of soft woods in proportion to its weight and because it possesses tremendous shock-absorbing qualities. Another valuable property is that it does not splinter when hit by missiles. Sitka spruce, white spruce and red spruce are used, the Sitka spruce being preferred. When spruce cannot be obtained, fir and Port Orford cedar are used. Practically all the spruce suitable for this purpose is found in the United States and along the western coast of British Columbia.

Molten Slag Is Hauled by Rail for Making Embankments

Union Railroad at Pittsburgh Handles Hot Materials in Ladle Cars—Fills Made in Layers Prove Very Substantial

DISPOSAL of large quantities of blast-furnace slag in the Pittsburgh iron and steel district is effected by dumping it to form railroad embankments and to fill areas of low ground which may then be utilized as industrial sites. Molten slag is hauled several miles in short trains of special ladle cars, which can be dumped at will. Cold openhearth slag is also disposed of in large quantities. About 1,600,000 tons of refuse is distributed annually. The hot material is said to have proved very satisfactory for railroad embankments, and by careful placing, with solidified material placed on the outside to serve as a retaining wall, can be made to stand almost vertically.

Transporting and dumping the molten slag is a special class of business on the Union R.R., which is a terminal line serving principally three of the large plants of the Carnegie Steel Co. in the Monongahela valley. These include the Edgar Thomson works, the Duquesne works, and the Homestead plant with its auxiliary the Carrie furnace, at Rankin. They have a total of 24 large modern blast furnaces. Later the railroad will serve also the Clairton plant, with three furnaces.

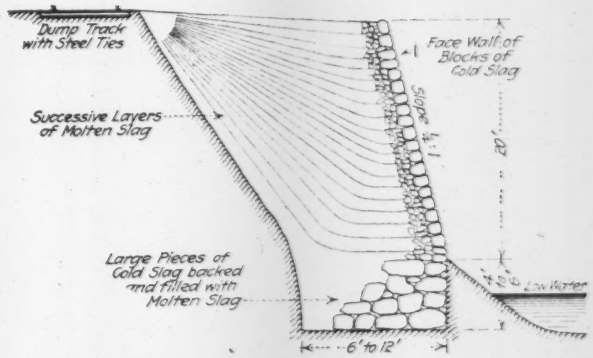
Slag output from the 24 furnaces has been about 2,000,000 tons per year for several years, and about 80% of this is disposed of by dumping in molten condition, mainly along the line of the Union R.R. Its weight in the dump averages 2800 lb. per cubic yard. Most of the molten slag not used in this way is granulated for use in the manufacture of portland cement, and for temporary ballast, yard ballast and special filling on the railway.

In addition to the blast-furnace slag, there is "cold filling" which averages more than 100 cars or 5000 tons per day. This includes openhearth slag, ashes and all other kinds of refuse shipped from the mills. It is used in making fills for plants, railway embankments and yards. Large quantities are turned over to the Bessemer & Lake Erie R.R. for similar use on its lines. After all this supply for useful purposes there is still a large amount that must be disposed of as waste.

For disposal of the molten slag and cold waste the Carnegie Steel Co. has acquired low-value ground in tracts of 60 to 400 acres along the line of the Union R.R. The largest is at Mifflin Summit, where dumping of molten slag has been in progress for about five years, and will continue for many years. The site is at the headwaters of some small streams and presented filling accommodations for 30,000,000 to 40,000,000 cu.yd., depending upon the final elevation of the surface. Of the smaller tracts, 60 to 100 acres each, some are for hot filling and others for cold filling. This facilitates operations and avoids trouble from fires starting in the cold filling. Heat is retained in the slag fill for long periods, depending upon the depth and mass.

Ladle cars consisting of ladles or pots mounted on railway trucks are used for handling slag which is to be disposed of in molten condition. The slag is tapped from the furnaces into these ladles, each of which has a capacity of 8½ cu.yd. or 13 tons. Trains are composed of from seven to fifteen cars hauled by a 70-ton engine, and a pusher engine of the same weight is used where there are more than eight cars. The haul averages seven miles, with a maximum of about 11 miles, and from 375 to 400 ladle cars are handled and dumped per 24-hour day.

Air-brake train lines on the cars provide for their control while in transit, and are connected to a compressed-air dumping mechanism on each ladle, which is thus operated from the locomotive. This mechanism is provided with a lock which holds the ladle steady and prevents it from tipping and spilling the slag along the track.


Dump Track with Steel Ties
Face Wall of Blocks of Cold Slag
Successive Layers of Molten Slag
Slope 1:¼
Large Pieces of Cold Slag backed and filled with Molten Slag
Low Water
6' to 12'

RAILWAY BUILDS EMBANKMENTS OF MOLTEN SLAG ALONG MONONGAHELA RIVER

During the longer hauls the slag cools sufficiently to form a crust from 1 to 2 in. thick over the top, and a cinder or skull on the interior surface of the ladle. At the dump, air from the locomotive is turned into the dumping mechanism of each ladle successively, tilting them gently but rapidly, thus discharging the molten material with sufficient velocity to throw it clear of the track. The ladle is tipped until its lip is about level with the top of the ties, in order to drain it thoroughly and discharge the hard skull. These skulls generally break when discharged, and on low dumps the pieces tend to remain near the railway track, while on the higher dumps the larger pieces usually roll down the slope.

Solid floors on the bridges prevent any splashing slag from falling into the streets. Should the ladle be so full as to overflow slightly when the train is rounding a curve, the spread of the vessel generally throws the material clear of the ties. The small amount spilled in this way is usually spread out on the ground so that it does not retain its heat long enough to set fire to hardwood ties. Steel ties, however, are used mainly on the Union R.R., having been adopted as standard several years ago. But even when wood ties were used it is stated that there was very little trouble from burning them with the slag.

Steel ties are used exclusively on the hot-slag dumps, and these stand up well, it is said, under the severe treatment to which they are subjected. When wood ties

were used on these dumps there was considerable trouble from burning, caused by the discharged slag and more particularly by the drippings from the ladle and the congealed cinder or skull mentioned above. In fact, these skulls were found to be the principal trouble, especially if they remained near the track, owing to their mass and their interference with the free spread of the molten slag.

Cold filling is handled largely in ordinary steel bottom-dump hopper cars, but the railroad has a large number of special side-dump cars of the Summers and Clark types which are used extensively in this service. The labor cost for disposition of the material is considerably higher than that for the hot slag. For leveling the cold fill a Jordan air-operated spreader car is sometimes used.

Slag deposited hot has been found to make a very substantial fill, and both the Carnegie Steel Co. and the Union R.R. Co. have built sructures upon this material. It permits of an almost vertical wall being constructed along the limits of a fill if this is required, although usually a slope of ¼:1 is allowed. This method has been used for filling out to the limiting lines of the channel of the Monongahela River, along which a number of the steel company's works are situated and which is skirted by the main tracks of the railway.

How Embankments Along River Are Made

For these railway embankments along the river a trench is usually excavated to a little below the low-water elevation. This is filled with cold slag, such as ladle skulls and blocks of openhearth and converter-mill slag. The front of this filling is carried up to 12 or 24 in. above ground, and the space behind it is filled with molten slag, which trickles through the openings in the face and thus cements it into a solid mass. Where any water stands in the trench the slag tends to granulate, but the heavy blocks embedded in it have been found to provide ample stability.

When the semi-liquid fill reaches the top of the face wall the latter is built up about 18 in., and the pouring of slag is then repeated. These operations are continued until the fill has reached the desired elevation, as shown by the accompanying drawing. More than six miles of main line have been built on fills of this kind.

For the waste dumps no restricting walls are required. A single-track roadbed is excavated in the side-hill slope of the ravine or other low land to be filled, and from this the dumping is started. The molten slag usually spreads well down the slope. While the fill is made more or less in layers, each hot deposit bonds itself to the preceding layer, so that the entire dump forms a solid mass. When the fill has widened sufficiently the track is shifted out to the edge. This process of dumping slag and shifting track is continued, the fill increasing until in one place it is 150 ft. high. It has been found that the higher the dump the more nearly the slope tends to a vertical face.

Molten slag cools quickly when allowed to spread freely, but the skulls retain their heat for a considerable time. Pools of hot slag are caused by the skulls and by irregularities on the slope, and these cool more slowly. Even in such conditions, however, the men can usually walk over the dump in about an hour after the pouring, in winter, and from four to five hours in summer.

In preparing to shift the dump track to the edge of the fill the deposit of crusts and skulls must be leveled and slag drippings removed, the latter accumulating near the ends of the ties so that they cannot be shifted. This work was done formerly by hand, but a Mann-McCann air-operated steel spreader car is now used. The spreader wing of this car is fitted with a special plow which cuts a deep furrow just outside the ends of the ties, thus breaking up the congealed slag drippings from the ladles. This machine can be operated directly after the slag has been poured, so that the lining and surfacing of the track can be done in less time than when the leveling was done by hand.

The saving in labor due to the use of the machine is expected to be considerable. A certain number of men are necessary for shifting the track, and must be available when required. This number is considerably more than would be required for ordinary dumping operations.

If this gang of men can be employed for a portion of the time on other work in the vicinity, or if it can be worked on a series of dumps in succession, it is pointed out that there will be a greater saving than if the entire gang must be kept at one dump. Again, more track shifting is necessary on a low dump than on one of considerable height, so that the saving per cubic yard or per ton of slag dumped cannot well be stated. From thirteen to twenty men are used in lining the dump track, depending upon its stiffness due to curvature or other conditions.

Disposal of the entire refuse product is made by facilities owned or controlled by the steel company. The material goes to the trunk-line connections only when they ask for it in case of washouts and other emergencies.

Information as to this special kind of filling has been furnished by E. C. Brown, chief civil engineer of the Carnegie Steel Co., and D. E. Woozley, engineer maintenance of way of the Union Railroad.

Inaugurate Patrols on Wisconsin Highways

A patrol system for the maintenance of the Wisconsin state trunk highways was organized May 1, as provided by law, by the counties in which the roads lie. A. R. Hirst, state highway engineer, in a quarterly report to J. G. D. Mack, state chief engineer, reports that 555 maintenance patrolmen have been employed. While the system is only two months old and still far from perfect, a favorable showing has been made, according to the report. One outstanding fact is that the man-and-team patrol is far superior to the truck patrol in all ordinary circumstances. Construction in the counties will be about 40% of the work originally financed, although the commission issued authority for 45% of this construction contemplated for this year under tne state highway law. Engineer employees of the division continue to enter the United States service, nine men leaving during the quarter which ended July 1. Mr. Hirst says, "We give them up gladly, but their departure creates a very difficult situation, as it is impossible to fill the vacancies with men of like capacity."

Army Supply Depot at Chicago Is Large Concrete Warehouse

Floor Area Twenty-Nine Acres in Six-Story Building—Tracks on First Floor—Tunnels For Trucking and Utilities

BY A. EPSTEIN
Structural Engineer, Central Manufacturing District, Chicago.

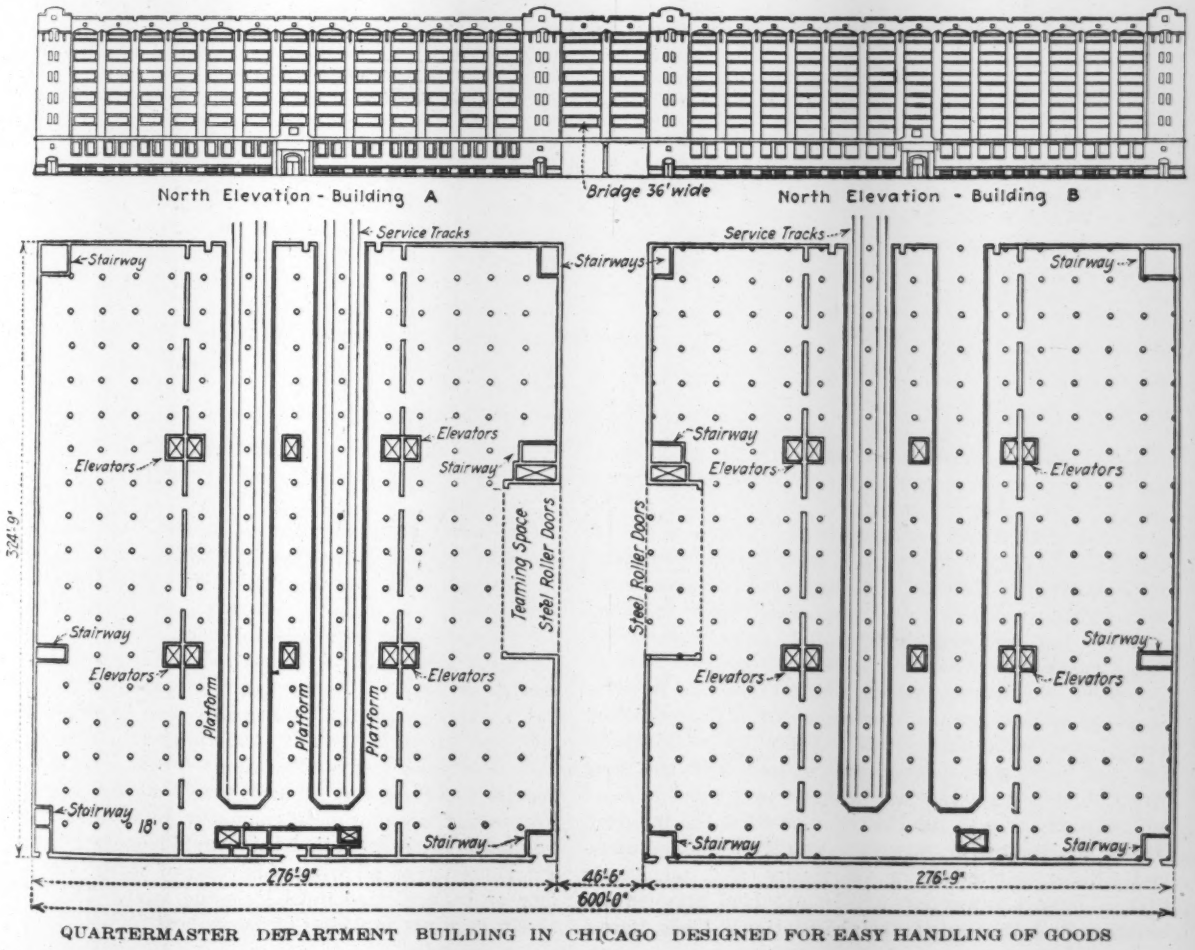
ONE of the largest reinforced-concrete buildings in the world is now being completed by the War Department at Chicago for use as a permanent interior storage depot for the Quartermaster Department in its system of inland and terminal storage warehouses for the army. The Chicago depot is located in the Chicago Central Manufacturing District and is on Government leased ground in that district, now occupied also by many temporary structures all devoted to storage purposes.

The new building consists of two units, A and B, each having a frontage of 276 ft. on 39th St., and a depth of 324 ft., and each being six stories in height, with a basement. They are separated for light and ventilation by a 46-ft. paved court, in which are situated the teamways extending into each building for a depth of 26 ft. and a length of 90 ft. Typical floors of the two units provide 180,000 sq.ft. of floor space, the total for the entire building being somewhat more than 1,250,000 sq.ft., or about 29 acres. By means of large rolling steel shutters the teaming spaces may be converted into fireproof garages with a total capacity of 10 large trucks in each building. Trucks partly loaded or unloaded can also be left in these inclosed areas overnight. At every floor above the first the two units are connected by means of an inclosed concrete bridge, 36 ft. wide, with fireproof rolling steel doors.

The buildings are of the simplest type of flat-slab reinforced-concrete construction, with columns founded on caisson footings and with skylight roofs in sawtooth framing.

The column design was made in accordance with the new revised city ordinance, which provides for bending stresses developing in the columns due to the possibly unbalanced floor loading. For the support of the interior and wall columns 600 caissons were sunk. These caissons vary in diameter from 4 to 4½ ft., and are designed for a load of 40 lb. per square inch. They are sunk to an average of about 25 ft. below the base of the floor level. At the bottom, where hardpan was encountered, the caissons were belled out to about twice the diameter, allowing 6½ tons per square foot on the hardpan.

The floors, of the Leonard flat-slab type, are designed for 300 lb. per square foot live load over the 18 x 18-ft. typical panels. The floors were poured to ½ in. from the top, and before the concrete attained its initial



QUARTERMASTER DEPARTMENT BUILDING IN CHICAGO DESIGNED FOR EASY HANDLING OF GOODS

set the surface was roughened to obtain a good binding surface for the top finish. Topping was a 1:1½ cement-sand mortar applied as dry as possible, floated and troweled until a smooth, hard and uniform finish was obtained. After hardening the floor was covered with sawdust and thoroughly saturated and kept wet for four or five days. No metallic hardener of any nature was used. The finish cost about 4¾c. per square foot.

To provide for expansion and contraction an expansion joint was made the center of the bridges connecting two units of the building. This joint was made by means of two 8 x 13½-in. concrete beams running in the short direction of the bridge, with ½ in. between the beams. Where the beams connect to the column a seat bracket was put on the column, the beams resting freely on this bracket. To facilitate free movement greased steel bearing plates were put under the end of the beams at the points of contact, and the space between the beams was covered with asphalt filler.

The building is served by tracks of the Chicago Junction Ry., four tracks entering each unit in the rear at the grade levels and continuing into the building for its full length. Loading and unloading are done from a 20-ft. center platform and two 10-ft. platforms at each side of the track. Thirty-two cars can be placed in each unit at one time. The center loading platform is a 5-in. concrete slab supported on girders running crosswise to the platform, resting on piers built on top of spread footings.

The entire train-shed area can be inclosed by means of 14 x 17-ft. rolling steel doors in the rear of the building at points where tracks enter. The first floor level was established at an elevation of 4 ft. above the top of the rail, and in order to allow for the swing of the doors on refrigerator cars slots 8 in. deep and 2 ft. 3 in. wide were left for some distance along the edge of the concrete platform. During loading and unloading of all cars, except the refrigerator type, these slots are covered with movable slabs flush with the remainder of the platform as well as with the car platform.

Concrete Walls Around Elevator

Each unit contains one 9 x 20-ft. truck elevator and seven 8 x 14-ft. standard freight elevators with provision for four additional elevators in each unit. Elevator inclosures around all typical elevators were made of 12-in. concrete reinforced on both sides of the wall with vertical and horizontal rods. These walls, in addition to being self-supporting, were designed to carry the load of the adjacent floor panels. The use of concrete walls around elevators was decided upon in order to afford the best possible durability to withstand the heavy trucking anticipated on the floors, as well as to replace the columns which would otherwise have to be placed in locations interfering with the clear elevator hatches and with passage to and from the elevators. Elevator walls were formed and poured with the floor directly above, making an integral and homogeneous unit. In addition to the electric elevators, the building will be equipped with conveyors, spiral chutes and automatic intercommunicating telephones and pneumatic tubes. Tunnel connection will be provided between the building and the union freight station. This tunnel will be of sufficient size to serve for the movement of l.c.e. freight and express by means of four-wheel trucks hauled by electric tractors. The basement floor on each side of the track is connected by a 16-ft. tunnel passing under the tracks and reinforced to carry the engine load. The remaining portion of the track space is left unexcavated, with the tracks resting directly on the ground.

The building is equipped with a sprinkler system, steam heat, electric-light and gas connections. Power and water are supplied from the power house and gravity tower owned by the district and situated about a quarter of a mile west of the building. The building is connected with this power house by means of a concrete service tunnel along the front wall of the building. The tunnel is 7 ft. high and 6 ft. wide, and is situated directly under the sidewalk in front of the building in such a way that the top of the tunnel serves as a sidewalk.

In the entire job the following amounts of different materials were used: Concrete, 62,000 cu.yd.; forms, 4,000,000 ft.-b.m.; reinforcement, 3500 tons; sprinkler heads, 13,000, and piping in conduits, 450,000 lin.ft. The building can store about 7600 cars of supplies and its elevators have a total lifting capacity of 77 tons. The total cost of the building will be about $3,000,000, at the rate of $2.40 per square foot of floor area, or 18c. per cubic foot of volume. Very rapid construction, following a rigid time schedule, will bring the probable date of completion to about Sept. 1. Excavation was started Mar. 6. An arbitrary date for completion was set at Oct. 15.

The plans for the building were prepared under the direction of S. Scott Joy, architect for the Central Manufacturing District. The work of construction was intrusted to the E. W. Sproul Co., general contractors, and the Tait Engineering Co. prepared the structural plans for the building. The work was in charge of Maj. F. L. Nelson, U.S.N.A., constructing quartermaster for the construction division of the Army. He was aided in his work by G. C. Nimmons of Chicago, supervising architect, and F. T. Forbes, supervising engineer. The writer assisted the architect in working out the engineering features of the building and in the supervision of the work.

Put Street Repair on Scientific Basis

That street repair should be put upon a scientific basis was asserted recently by Robert Hoffmann, chief engineer of the Department of Public Service, Cleveland, Ohio. The repair of the city streets of Cleveland, which was under a separate department, has now been placed nominally under the chief engineer. The former system, with a separate repair department, was unsatisfactory, and the present arrangement has been but partly successful, principally due to shortage of help and funds, it is said. Mr. Hoffmann believes that instead of making appropriations for maintenance and repair, a certain levy in each year's taxes, based on a program of keeping maintenance up to standard, should be made. He asserts that this would overcome the present necessity of allowing this class of work to accumulate or be neglected until it is too late and the whole street requires repaving at heavy cost.

Concrete Barges Designed for New York State Canal

Shipping Board Prepares Plans for 500-Ton Towboats To Be Operated by Federal Railroad Administration

CONCRETE towboats to be operated by the United States railroad administration on the New York State Barge Canal are to be built after a design prepared by the concrete ship department of the United States Shipping Board, Emergency Fleet Corporation. This design follows in general outline the design of the 3500-ton reinforced-concrete ship prepared by the same department and illustrated in *Engineering News-Record* of July 4, p. 17; that is, the barge has a center and two side keelsons forming the longitudinal stiffeners and side frames of normal reinforced-concrete girders spaced 5 ft. on centers and carrying an outer single shell.

The barge is 150 ft. long, 21 ft. beam and is 12 ft. deep at its side. It has a loaded draft of approximately 9½ ft., a displacement loaded of 756 tons, and a deadweight carrying capacity of about 489 tons. It is of the open-hull type, with cargo hatches 14 ft. wide, leaving 3½ ft. side decks. At bow and stern are cabin and storage spaces. It is intended that the barges be towed in groups of four, the largest number of this size which can pass a lock in the New York State Barge Canal at one time.

The reinforced-concrete details are shown in the accompanying drawings. The barge is practically square for most of its length, with rounded bow and formed stern. The main frames along the bottom are 6 x 18-in. girders with square bar reinforcement in upper and lower planes connected by small bar stirrups. This frame turns at the corners, where it is reinforced by extra stirrups, by increasing the depth and by diagonal rods. The vertical part of the frame is a 6 x 12-in.

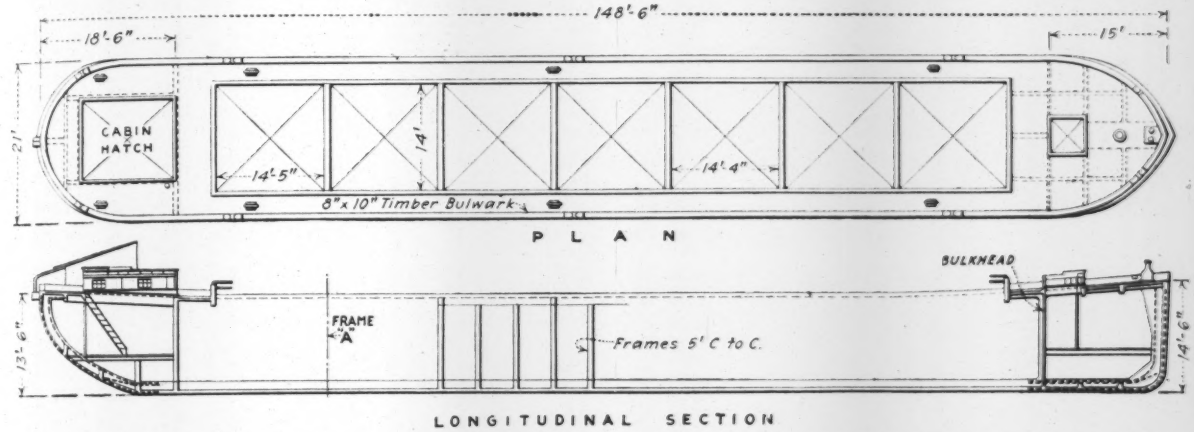


FIG. 1. 500-TON CAPACITY TOW BARGE OF CONCRETE NOW BEING BUILT FOR NEW YORK STATE BARGE CANAL

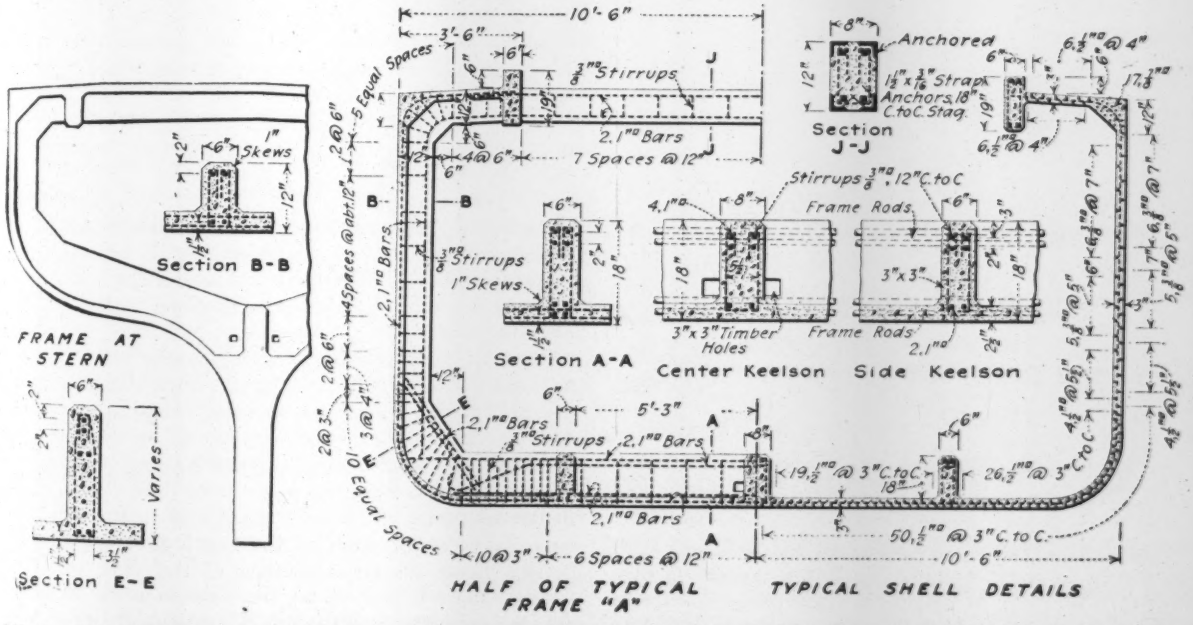


FIG. 2. CONCRETE BARGE SECTION, OF REINFORCED-CONCRETE GIRDER FRAMES CARRYING THREE-INCH SHELL

girder. It turns at the deck to the hatch combing and every fourth frame is carried across the hatches as a cross-brace. The shell is 3 in. thick throughout except forward of the forward bulkhead, where it is 4½ in. thick, and aft of frame 26, where it is 4 in. The deck slab is 3 in. thick. Both the shell and deck slabs are reinforced with ½-in. and ⅝-in. rods running horizontally and spaced variously, according to the location in the shell or deck. There are also ½-in. vertically running shear rods spaced 7 in. c. to c. Additional stiffening of the shell at the turn between the side and the deck is gained by a number of extra longitudinal rods, as shown in the detail. All horizontal steel in the side and the midship section is carried around the bow and the stern. The steel in the bottom and the bilge is carried forward and aft as far as possible without interfering with the steel from the sides.

A bulkhead is placed across the ship 15 ft. from the bow. This consists of a 3-in. vertical wall bearing against three 7-in. vertical girders which frame into longitudinal deck girders, as shown in the detail drawing, Fig. 4.

There is a wooden floor in the hold consisting of 4-in. plank laid across the hull frame and extending up the sides to the underside of the deck. The hatch covers are of timber frames which can be lifted off the seat and are made up of 6 x 8-in. yellow pine timbers bolted to the reinforced-concrete girder forming the hatch combing.

The specifications for the concrete work have some novel features. The cement is to be ground to such a

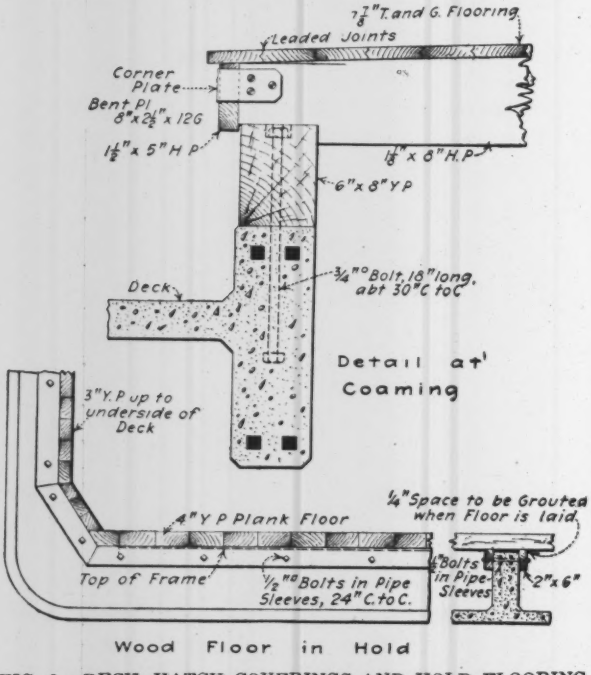

7⅞" T. and G. Flooring
Leaded Joints
Corner Plate
Bent Pl. 8"x2½"x 12G
1½" x 5" H.P.
1½" x 8" H.P.
6"x 8" Y.P.
Deck
¾" ø Bolt, 18" long, abt 30" C. to C.
Detail at Coaming
3" Y.P. up to underside of Deck
¼" Space to be Grouted when Floor is laid
4" Y.P. Plank Floor
Top of Frame
½" ø Bolts in Pipe Sleeves, 24" C. to C.
¾" Bolts in Pipe Sleeves
2"x 6"
Wood Floor in Hold

FIG. 3. DECK, HATCH COVERINGS AND HOLD FLOORING OF CONCRETE BARGE ARE OF WOOD FRAMES

fineness that a residue on a standard No. 200 sieve shall not exceed 10% by weight. So fine a cement is prescribed in the hope of getting a high-strength concrete at a comparatively early date. The aggregate is not to

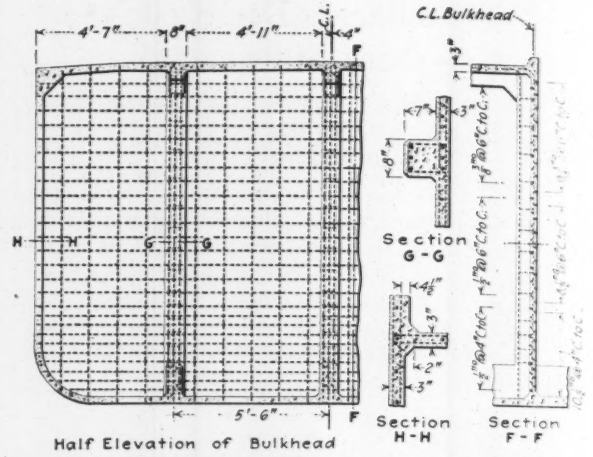


FIG. 4. COLLISION BULKHEAD A VERTICAL SLAB BEARING AGAINST VERTICAL GIRDERS

be more than ½ in. in greatest dimension. All concrete is to be mixed continuously for a period of at least 2 min. after all the materials are in the mixer. Concrete for the slabs—that is, for the deck, bulkhead and shell—is mixed in the proportion of one sack of portland cement, ⅝ cu.ft. of fine aggregate and 1⅛ cu.ft. of ¼-in. aggregate.

Fine aggregate is sand or crushed gravel passing when dry a standard No. 8 sieve and ¼-in. aggregate must have such dimensions that it will pass when dry a sieve having ¼-in. square openings and be retained on a standard No. 8 sieve. For the frames a concrete can be used consisting of one sack of portland cement, 1 cu.ft. of fine aggregate, and 2 cu.ft. of ½-in. aggregate. Continuous concreting is to be carried out if possible. In case a joint is necessary only one will be allowed, and that will occur on a line 2 ft. below the deck of the barge.

Contracts for the construction of these barges, to be built at sites accessible by water to the New York State Barge Canal, have been let by the railroad administration, as given in detail in the news columns of this issue.

Large Increase In Use of Motor Trucks In New York State

The use of motor trucks in New York State increased 47% during the year which ended July 1, according to a report issued by Secretary of State Hugo. This increase occurred in a period when general motor vehicle usage increased only 21 per cent.

The total registration of motor vehicles was 422,853. Of these 335,245 were passenger vehicles, an increase over 1917 of 15%; 67,330 were motor trucks, an increase of 47%; and 16,319 were omnibuses, an increase of 72%. These figures are considered very interesting because the increases have occurred under abnormal conditions. The increase in passenger automobiles is particularly so in view of the many pessimistic predictions made in the early part of the year. It was thought that although motor truck usage might increase pleasure car sales would show a decrease.

Iowa County Puts Road Maintenance on Sound Basis

Patrol Men with Team and Wagon Get $150 per Month—County Engineer Gives Clear Instructions—Dragging a Separate Item

By J. L. Parsons
County Engineer, Webster County, Iowa

MAINTENANCE of its road system by the common method of hiring farmers to do the dragging and any available person to make the usual repairs, has until recently been the method employed by Webster County, Iowa. Haphazard maintenance and confusion in placing responsibility for the correction of defects where it belonged was the usual and inevitable consequence. So, for 1918, the board of supervisors, in cooperation with the county engineer, have initiated a program which promises much for the future serviceability of the county road system.

As yet the county has but a small mileage of completed gravel roads—which require intensive maintenance—so with the idea of experimenting on a conservative basis, provision was made for only four patrolmen, and the 187 miles of county roads were apportioned so that each patrolman would reside near the center of his territory. As was previously the case, about 72 draggers are employed to do the periodic dragging.

Patrolmen Get Precise Instructions

The work of the patrolmen will cover the general maintenance and repair of the roads as set forth in the following instructions:

"Each patrolman should inspect all of his county roads often enough to be sure that the roads are in good condition, especially in wet periods. During the inspection work sufficient time should be taken on each mile to keep all bridge and culvert openings clear, level bridge approaches, fill holes in the road, keep side ditches open, remove stones from the road, and do all other necessary repair work.

"The grader should be used early in the spring to shape the roads, especial attention being given to the leveling of the ridges formed in the center of the road by draggers and the shaving off of the grassy strip along the sides of the road. The light graders are not intended to be used in the road ditches, excepting where they are useful for opening watercourses. After the roads are shaped properly in the spring the graders should be used for repair work on short sections, and often enough on all the county roads to prevent the growth of grass and weeds.

"All entrance culverts are to be placed and kept in repair by the patrolmen. In case new culverts are necessary in places where the water does not drain both ways away from the gate or cannot be cared for by inlets to tile drains, an order for the required culverts should be sent to the county engineer. Also necessary road culverts should be ordered and cared for in the same manner.

"The township plats furnished should be frequently consulted in order that the location of tile lines may become familiar and the tile kept in repair. In all low places where there are not inlets installed, inlets to tile lines should be constructed by the use of 8-in. sewer pipe thoroughly cemented to the tile and at the joints and covered with 8-in. cone grates sold by the Fort Dodge Foundry. All necessary materials should be ordered on the requisition blanks. It is very important that all inlets be kept open and in repair.

"As much as possible the character of the work done by the draggers should be investigated and the draggers instructed as to proper times and methods of dragging and the care and repair of drags. In cases where the dragging is neglected the patrolman should have the dragging done by using the grader, by using an extra team on the drag, or by employing additional help. In case a dragger unreasonably neglects his work the facts should be reported to the county engineer.

"All bridge repairs on the county roads will be in charge of the patrolman. The lumber owned by the county should be cared for and all possible precautions taken that it be not used for private purposes. Repairs on township road bridges will be done by patrolman when directed by the county engineer or supervisor. Additional help may be employed for this purpose when necessary. Only repair work on bridges proper should be done on township road bridges, as the township is responsible for all grading.

"The county roads should be kept clear of obstruction for the entire distance between fences by the destroying of brush, trees, etc. It is the duty of property owners to cut weeds and grass and these owners should be urged to do this work. In cases where the property owners refuse the county engineer should be notified and special instructions will be issued.

"Additional copies of the plats showing locations of tile lines and bridges will be furnished whenever needed. Any information gathered not shown on the plats should be reported to the county engineer. Requisition books will be furnished to each patrolman and signed requisitions must be issued for all material and labor ordered. Carbon copies of all requisitions should be kept and forwarded to the county engineer each month with the monthly report. Each day the patrolman's time should be entered in the proper columns on the monthly time report sheet. When these reports are properly filled out and filed with the county engineer warrants in payment for the previous month's work will be issued by the county auditor."

With the idea of attracting competent applicants, a salary of $150 per month was offered for man, team and wagon, the county furnishing light graders and all other tools and equipment. Fortunately, incompetents and political favorites are not among the men who have been selected.

Patrol Work Under County Engineer

The board of supervisors has recognized the advantage of a centralization of authority and responsibility, and has authorized the county engineer to issue all necessary instructions and generally to supervise and direct the patrol work. Undoubtedly changes and readjustments will be found advisable, but the outstanding feature of a program of this kind is the adoption of a definite plan.

The great obstacle to the institution of progressive maintenance methods, in Iowa as elsewhere, has been the prevalent inertia of custom and prejudice. In

the prosecution of the general construction and maintenance work of the county in the past there has been as in other localities a measure of public criticism and impatience with progress and results. Some of this has been justified by conditions which were under the corrective control of the county officials, but much of it is unwarranted. In order that the facts may become more generally known and a proper basis for judgment be provided, the county engineer has adopted the plan of furnishing short, concise articles for the county seat press once each week. In the few months that this plan has been in operation a more friendly spirit of understanding and coöperation between the public and its officials is becoming evident.

Urges Improved Status for British Municipal Engineers

INTRODUCING the subject with the general statement that "practically everything that matters in the public life of the community depends, to a large extent, upon the skill and ingenuity with which municipal engineers deal with their problems," T. W. A. Hayward, borough engineer and surveyor of Battersea, England, devoted a considerable part of his inaugural address, as president of the Institution of Municipal and County Engineers, to the status of municipal engineers in Great Britain. A joint committee on the status of municipal engineers, Mr. Hayward said, has reported its conviction "that it would be to the public advantage if the qualifications of municipal engineers were investigated, their duties more clearly defined, and their salaries fixed on some more consistent basis than is now the case." The committee was of the opinion, Mr. Hayward stated, that "appointments of municipal engineers should be under the supervision and control of the Local Government Board to the same extent as are those of medical officers of health." Continuing, Mr. Hayward said:

"Hitherto a local authority has been able to appoint as its engineer and surveyor a person who has had neither the scientific training nor the practical experience which are necessary for the proper execution of the work he is expected to devise and control, without even a comment from the Local Government Board. The council of this institution has recently been compelled to refuse to admit to membership men who have been appointed to positions of responsibility but who do not possess the necessary qualifications."

Constantly changing membership of municipal councils, with frequent reversals of policy, were mentioned by Mr. Hayward as one of the drawbacks to municipal service. The speaker declared that "too often, alas, the faithful officer is persecuted because he dares to do what he considers right when he comes into conflict with counselors and others whose interest may be disturbed, and his life is made so unbearable that he has no alternative but to resign his position."

Finally, Mr. Hayward spoke of the coöperation between his institution and the National Association of Local Government Officers in promoting superannuation, adding that at present the Local Government Board is moving toward the appointment of a special committee to investigate this subject.

Looking Back Half a Century

How a Young Engineer, Since Grown Famous, Got His Start in the Engineering of That Day

By Charles Whiting Baker
Consulting Editor, Engineering News-Record

RUDOLPH HERING, the dean of American sanitary engineers, completed on June 1 his fiftieth year of active work in engineering. It was in June, 1868, that young Hering, just returned to America from four years of study in an engineering school in Dresden, Germany, landed his first engineering job—the humble position of chainman on the survey of Prospect Park, Brooklyn.

Engineers were few in those days, it is true; but engineering positions were few also. In his studies Hering had specialized in bridge and railway engineering, and was eager to put his newly acquired scientific knowledge into practice; but bridge building as a business was hardly born and railway companies in those days used engineers merely in the original surveys and construction. When a railway was once built there was supposed to be no further use for engineers.

Hering had not the slightest premonition of where his future career was to lead. Chance, not intention, determined that—as is very generally the case with engineers as well as other men, regardless of laborious specialization in the schools.

Told to Take First Job He Could Get

Rudolph Hering's father was an eminent scientist and physician of Philadelphia, who immigrated to the United States from Germany in 1826. Among his intimate friends was Julius E. Hilgard, who was later head of the United States Coast Survey. To young Hering, in his quest for work, Hilgard gave letters of introduction to half a dozen well known engineers, among them his personal friend Alfred P. Boller, the bridge engineer. Mr. Boller sent Hering to James P. Kirkwood of Brooklyn, then the most eminent American authority on the filtration of water. Mr. Hering recalls Kirkwood's advice to him to take the first engineering job he could get, no matter how humble or in what field of work, if he wanted to break into engineering. Through Kirkwood's recommendation, Hering became chainman in one of the field parties then working on Prospect Park, in June, 1868.

The first chief engineer on the Prospect Park construction was Joseph P. Davis, who later became city engineer of Boston, and afterward achieved important success as engineer of the Bell Telephone Co. The landscape architects for Prospect Park were Olmsted and Vaux, fresh from their great success in the creation of Central Park. Mr. Davis was a careful, methodical engineer who prided himself on laying out work accurately and computing excavations and embankments to close limits. To change the plans during the progress of work was, to his mind, little short of criminal. Very different were the ways of the landscape architects. Where the merit of work lies in its appearance to the eye, how shall you tell beforehand to a hair's breadth what shall be done?

"Mr. Davis," Vaux would say on one of his frequent visits of inspection, "I don't like the looks of this slope. Won't you fill in two or three feet more here? And this

path had better be swung off in this direction instead of where you have built it." Such was the havoc played with the engineer's careful calculations that it worked on Davis's nerves till he resigned in disgust.

Another Nestor of American engineers still in active professional work who was on the Prospect Park survey fifty years ago was John Bogart, who held the position of principal assistant engineer. Mr. Bogart later became widely known to the profession by his services as secretary of the American Society of Civil Engineers for the twelve years from 1878 to 1890. Later he did valuable pioneering in hydro-electric power development in planning the first harnessing of Niagara Falls.

Another important member of the Prospect Park group was C. C. Martin. He was the chief engineer from 1867 to 1870 and later served for many years as chief engineer of the Brooklyn Bridge when that structure was counted among the world's greatest engineering works. Still another was A. M. Wellington, who was leveler in the division adjoining Mr. Hering's, and whose notable work as editor of *Engineering News* from 1887 until his death in 1895 is still fresh in the memory of many engineers.

In 1868, when Prospect Park was in the making, there were only dreams of a bridge connection with New York City. Brooklyn was a residential city for those who did business in New York (which meant the lower end of Manhattan Island) and was famous far and wide as "the City of Churches." Prospect Park was to be just such a recreation spot for these "suburban dwellers" as the newly opened Central Park was to New Yorkers who lived "uptown" (above 14th Street).

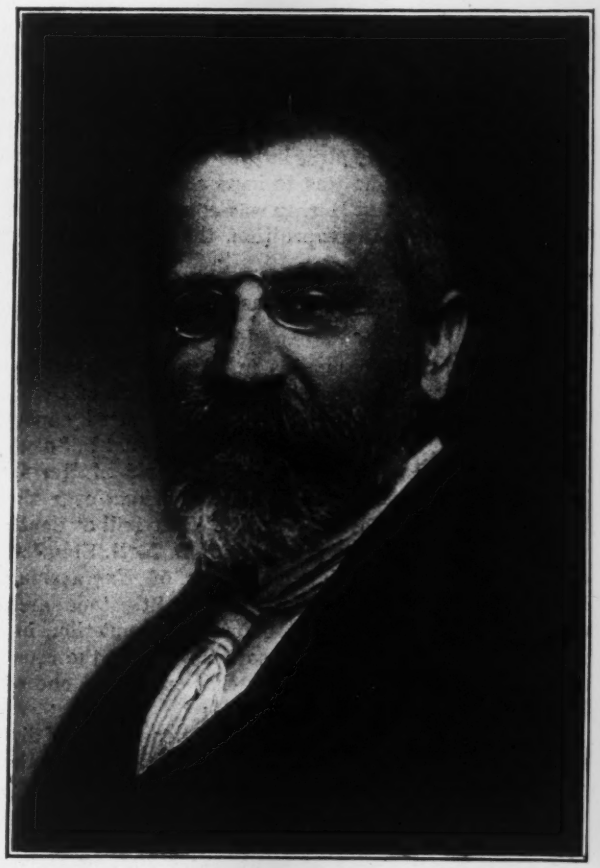
The only means of travel for New Yorkers in going to and from business was the Broadway omnibuses (whose chronic congestion in rush hours was the first example of that coming "peak of the load" which was to be such a problem to the engineers of a future generation) and a few newly built horse-car lines. The same class of New York business and professional men who nowadays flock to the New Jersey suburbs to escape the congestion of Manhattan Island went to Brooklyn to find homes in the fifties and sixties.

No one at that day foresaw Brooklyn as a vast hive of manufacturing industry. Even the farsighted Wellington, in his notable studies of the future development of greater New York, published in *Engineering News* in 1887, soon after he became its editor, placed his entire emphasis on Brooklyn as a residential city for those who earned their living in New York.

The work of young Rudolph Hering on Prospect Park lasted only a year. Funds ran low, and in 1870 the work had to be suspended for a time. So the future sanitary engineer, who was still longing to be a bridge engineer, sought another job and found it in his own home city of Philadelphia, where the new Fairmount Park was just then being laid out. Here again his work was surveying, but he was put in charge of a party.

The first task was to make a topographical map of the area. Hering had been instructed abroad in the then little known art of surveying with a plane table, and he suggested its use for the Fairmount Park surveys. He met with no encouragement until he broached his idea to the principal assistant engineer, Hermann Schwartzmann, who had also had experience abroad. To Hering's suggestion that the plane table be used, Schwartzmann replied, "Of course that's the best way to do it; but nobody here knows how to use a plane table." "Well, I know how," said Hering. "Then use it, by all means," said Schwartzmann.

Another young engineer associated with Hering on the Fairmount Park work was Lewis M. Haupt, who a few years later became professor of civil engineering at the University of Pennsylvania. Still another was J. Foster Crowell, who was assistant engineer for the area east of the Schuylkill River while Mr. Hering was



RUDOLPH HERING

engineer for the west side. In later years Mr. Crowell was a well known consulting engineer in New York City and was at one time commissioner of the Street Cleaning Department.

It is a little difficult to realize now that at that day the making of surveys and measurements was considered the chief function of an engineer. An engineer was a man who used a chain, a compass and other instruments set up on three legs, who set down figures in a book and drove stakes marked with red chalk that told where this and that was to go. There was an underlying reason why engineers were not in demand except for the absolutely necessary work of surveying, and were especially not wanted to meddle with anything relating to prices or to the award of contracts. Those were the palmy days of corrupt municipal government in the United States. Most cities were governed by political

machines which were run for the enrichment of the "machinists."

Relics of that old-time view of the engineer still survive, as in the State of New York, where the state engineer is required by law to do the scientific and mathematical work in connection with the state's public enterprises, while the award of contracts and the inspection of contract work are reserved to the Superintendent of Public Works, who is by tradition a carefully selected politician.

In January, 1872, about the time the Fairmount Park surveys were completed, the newspapers were full of the discoveries of wonderful spouting springs in the Yellowstone region of the Rocky Mountains. Congress had set aside for a national park a great tract 60 miles square containing these geysers. Hering was becoming a park engineer, so why not seek a job there? Through his father's friend, Hilgard, he was introduced to Hayden, the geologist, who was to head an exploring party to the Yellowstone, and Hering was appointed one of the two astronomers of the expedition, the other being the late Henry Gannett.

Predicted Fall of Bridge

After six months of active adventure in the Yellowstone, and another six months in Washington working up the data, Hering returned to his home town of Philadelphia and at length gained his long desired opportunity to practice bridge engineering. Samuel L. Smedley, then city engineer of Philadelphia, placed Hering in charge of the new Girard Avenue bridge over the Schuylkill. Another bridge over the Schuylkill at South St. was at the same time in charge of D. McN. Stauffer, who eight years later became editor of *Engineering News*. This was the ill-fated South St. stone arch structure which fell in ruins before its completion, because there was a stratum of soft clay below the crust of hardpan into which the piles that supported one of the piers were driven.

That failure was one of the notable engineering disasters of the time. The slow, steady settlement of the pier and the consequent distortion of the arch were accurately measured by Hering, and the curves of pressure as well as of settlement were plotted day by day. One Thursday Hering said to his chief, "Mr. Smedley, that arch will fall in a few days." On Saturday he computed that it would fall on Sunday morning about 7 o'clock. At 7 o'clock Sunday morning Hering was at the site of the work, but at 6 a.m., within an hour of the time he had predicted, the huge masonry arch had crashed to the ground.

It should be said here that neither Hering nor Stauffer was responsible for the design of the bridges on whose construction they were the resident engineers.

After three years spent on the Girard Ave. bridge, City Engineer Smedley in 1875 transferred Hering to a field of work in which he was later to become an eminent specialist—the city sewer department. Not that there was much to be learned by a young engineer in the Philadelphia sewer department of that day except the art of how not to do it. Hering was the outdoor assistant, having chiefly to do with the construction of the main sewers and bridges.

In those days in Philadelphia and numerous other cities of eastern Pennsylvania the pedestrian along the streets was continually stepping over a little stream of soapy water flowing in channels across the sidewalk from the house to the street gutters. The smallest sewers built in Philadelphia were 3 ft. in diameter. These were built of a single 4-in. ring of brick laid up, except the arch, without mortar. Indeed, it was explained to young Hering on his entry into the sewer department, by the men of "practical experience" who were in charge, that the sewers must be built without mortar "so that they would drain the ground."

Found Sewer Built of Barrels

Naturally, cave-ins of sewers so built were frequent. One day news came that a street had caved in over a recently built sewer, and Hering was sent down to investigate. Sure enough, there was a long jagged ditch through the center of the street. Taking a pick, Hering started exploring to find the condition of the rest of the sewer, but he could not uncover any bricks. Instead he found barrel staves and hoops. On further inquiry it was discovered that the contractor had obtained a lot of barrels, knocked out the heads, placed them in the ditch, quickly covered them up, collected his money at so much per lineal foot of sewer laid, and departed with all convenient speed.

To a man of Hering's make-up, sewer building in Philadelphia was chiefly instructive as evidence of the need for great reforms—reforms in design as well as in execution. In other cities as well as in Philadelphia the time was ripe for breaking away from the traditions and the prejudices of the old school of sewer builders.

Col. George E. Waring was just then attracting wide public attention by his advocacy of small pipe sewers—a novelty which the leading engineers of that day fought against bitterly, but which the younger and more far-sighted men recognized must receive attention. In one of the discussions between Hering and his chief, Smedley, in 1878, the younger man proposed a trip to Europe to study foreign practice in sewer construction. Smedley approved and put in an application to the city councils for an appropriation to pay Hering's traveling expenses. The item attracted the attention of one of the lynx-eyed "watchdogs of the treasury" in the councils. "Go to Europe to study sewerage!" said he, sarcastically. "I can see through that. He wants a junket to see the Paris Exposition. Not on yer life."

Nevertheless, Hering did go to Europe to study sewer construction. In the spring of 1880, after again unsuccessfully trying to obtain aid from the City of Philadelphia, his old friend Hilgard introduced him to Dr. John S. Billings, then surgeon general of the Navy and vice president of the National Board of Health. Dr. Billings promptly welcomed the proposal and Hering went back to Philadelphia to tell his chief that the Federal Government was going to send him to Europe to study sewer design and construction.

So it was that the youth who had specialized in bridge work and railway engineering spent the first dozen years of his professional life on park surveys, bridge building and sewer construction, before he found an opportunity for large development along the line where his future career was to lie.

Other Values and Elements of Value, as Applied to a Going Railroad

Kansas City Southern Witnesses Tell Commerce Commission of Items Not Reflected in Cost of Physical Property—Call It Impossible to Appraise These Items Separately, but Give Total Value of Plant

EXTENSIVE testimony relative to "other values and elements of value" was offered by the Kansas City Southern Ry. Co. at a hearing before the Interstate Commerce Commission last March, in the matter of the valuation of that road. Mark Wymond, W. S. Kinnear and George H. Davis, consulting engineers, and L. F. Loree, chairman of the board of the Kansas City Southern, were among the witnesses. Each held that it was not feasible to fix the intangible values; each offered a figure for total final value, at which he said he arrived by careful consideration of all tangible and intangible elements of value and their relation to one another; and each insisted that the only way to determine the intangible value was to subtract tangible value from total value. Each witness gave earnings, both present and prospective, much weight in estimating total value. Strategic location, easy operating conditions, good terminals, and a good organization were all cited as elements of value, and the road was compared with other roads in the district. The figures offered for the total value of the Kansas City Southern ranged from $75,000,000 to $80,000,000, as compared with about $50,000,000 tangible value found by the Division of Valuation, and a much higher figure claimed by the company.

Mr. Wymond thought $76,500,000 the entire value of all the carrier property of every kind, tangible and intangible, on the valuation date. In arriving at this figure he considered the various cost figures—original, reproduction new and reproduction less depreciation; the market value of the securities, which totaled about $62,000,000; the location of the line, the operating conditions, the character of the country traversed and the traffic, present and possible; and the earnings of the company, present and prospective. He used the Missouri, Kansas & Texas, the St. Louis-San Francisco, the St. Louis, Iron Mountain & Southern and the St. Louis & Southwestern, all parallel and competing lines, as bases for comparison.

Mr. Wymond Cites Strategic Location

Extending from Kansas City, Mo., "a railroad traffic center of the first importance, the traffic originating and interchanged there being enormous," to Port Arthur, Tex., "a United States port of entry of considerable present and very great prospective importance," a distance of 789 miles, the Kansas City Southern, Mr. Wymond thought, had a strategic position of great value. He pointed to several stations along its lines which were "traffic centers of considerable importance," and to "immense resources in coal and other minerals, oil, lumber, petroleum and other oils for which there is a large and constantly growing demand," in the territory the road traverses.

Considering the Kansas City terminus of the line, he pointed to the Kansas City Southern as the shortest route to the Gulf of Mexico. He spoke of the many lines of railroad radiating from Kansas City in every direction, and cited the Chicago, Burlington & Quincy, Chicago, Milwaukee & St. Paul, Chicago Great Western, Chicago & Alton and Union Pacific, operating in the aggregate more than 23,000 miles of railroad. He held that as none of these systems operates south of Kansas City and as the Kansas City Southern does not operate north of it, they do not compete with, but rather supplement each other, and there is a very large interchange of traffic at Kansas City between the systems.

Superior Terminals

The terminals of the carrier at Kansas City, too, he found superior to those of any other system there. He stated that in 1914 its switching revenue exceeded that of the Kansas City Terminal Ry., which is owned jointly by the largest 12 systems entering Kansas City. The carrier has direct physical connection with 15 other railroads in the city and on this account is more favorably located, he thought, than any other railroad there. In that connection, he observed that the principal element of value of such terminals was not dependent on the cost of producing the physical property employed, but on their favorable location, bringing to the carrier a very large percentage of its total freight traffic and revenue.

An element of value of the Kansas City Southern, according to Mr. Wymond, was the comparative absence of branch lines. He held that the operation of branch-line railroads is seldom profitable; that railroad systems construct or acquire them because the anticipated profits on the traffic which they contribute to the main line exceed the losses incurred in the operation of the branch lines, and that the Kansas City Southern, through its connections at various points, derived the benefit of feeders without incurring the losses in their operation.

The southern terminus of the carrier at Port Arthur, Tex., he held to be an element of value. He pointed to the terminals there and their capacity for handling the large traffic, and laid special stress on the fact that they are seven miles inland from the Gulf of Mexico, at the head of a canal, and thus protected against Gulf storms.

That the roadbed of the carrier is well and substantially constructed, with embankments and cuts of standard width; that the track is well ballasted and the whole track system well maintained; and that the steel bridges are designed to carry the heaviest loads passing over the various divisions, Mr. Wymond thought were elements of value.

Nine Favorable Operating Elements

Considering the operating conditions of the road, Mr. Wymond pointed to nine favorable elements, as follows:

1. Greater freight traffic density than that of any of the other four railroads previously mentioned.

2. Grades favorable to economic operation.

3. Favorable location of division points, resulting in operating economy on account of reducing overtime of trainmen.

4. Good balance of traffic in both directions, under normal conditions.

5. Longer average haul of freight than on any of the other four lines.

6. The fact that three items—coal, forest products and petroleum products—that are staples of commerce, with constant and practically uniform movement throughout the year, made up more than 59% of the total tonnage moved by the railroad in 1916.

7. Well located industry tracks, ample yards and passing tracks.

8. Abundance of both coal and crude oil along the line, insuring a minimum cost of fuel for company purposes.

The effect of these favorable conditions, said Mr. Wymond, is reflected in the ratio of operating expense and gross revenue, which was 62.86% for the Kansas City Southern and from 64.35% to 76.54% for the other four roads.

Of these eight favorable conditions, Mr. Wymond pointed out that only three are dependent upon or have any relation to the cost of the physical property, those conditions being the second, third and seventh.

Prospective Earning Power Most Important

Earning power, present and prospective, Mr. Wymond considers the most important element to be considered in placing a value upon the property. He differentiated earning power from earning capacity. The latter is limited by the capacity of the physical property to move the traffic. The former is limited by the opportunity to move the traffic, and in considering it he said account must be taken of the "adaptability, condition and efficiency of the physical property; the strategic position and all other conditions that determine the density and character of the traffic, present and prospective, and the net income, present and prospective, resulting from these characteristics of the physical property, the traffic conditions and the schedule of rates applying on the traffic moved."

To arrive at the prospective earning power of the carrier, Mr. Wymond considered the net income for the fiscal year 1914 and also the trend as reflected by the figures for other years before and after 1914. The net income of the carrier for 1914 he stated to be $3,515,276, which, capitalized at 6 per cent., amounted to $58,587,933. On the assumption that the net income would remain indefinitely the same as of 1914, he thought $58,587,933 might be regarded as the value of the property. But the figures from 1905 on indicated a rate of increase per year of $214,979.20 in net income, and the records for the year which ended June 30, 1917, seemed to him to strengthen his belief that that increase would continue. The net income for the year which ended June 30, 1917, capitalized at 6 per cent., would amount to $73,030,167, and the prospective net income for the year ended June 30, 1924, similarly capitalized, would amount to $94,416,667.

Mr. Wymond thought 10 years a proper period to use in considering the prospective earnings of the carrier, for the reason that the territory served directly by it is only partly developed. With respect to the possibility of changes in rates, he thought it fair to assume that the rates in effect were reasonable, prescribed by competent authority, and that the relation existing between gross revenue and net income would be preserved should changing conditions require a raising or lowering of the general level of the rates. He thought, furthermore, that the level could not be lowered without confiscating the property of some of the other four railroads which he considered, in view of their much lower net operating income per mile.

Intangibles Not Appraisable

He asserted that his judgment of value was based largely but not entirely upon present and prospective net incomes. In existing circumstances, he said, there is no method by which the exact value of the properties of the carrier may be determined. "It is possible, however, to state an amount below which the value of the property of the carrier cannot go.....The sum I have named as being the value of the carrier's property is probably less than the actual value.....It is a very conservative value that may be safely used for purposes of financing the property, or in considering a schedule of rates applying in the territory served by the carrier."

"It is not possible to state how much weight I have attached to any one of the many things affecting the value of the carrier property.....The elements of intangible value cannot be appraised separate and apart from the physical property.....If it should appear that the physical property of the carrier was worth $62,000,000, as claimed in its protest, instead of $50,000,000 as suggested in the tentative valuation, that would not affect my testimony as to the final or full value of all of the properties.....If the value of the physical property was placed at $77,000,000, I would still say that the total value was $76,500,000, unless there was some kind of an assumption made by the commission that any road that was indispensable to the commerce of any section was worth its cost."

In reaching his conclusions that $76,500,000 was the fair and reasonable value of the properties of the carrier, both tangible and intangible, as of June 30, 1914, Mr. Wymond stated that he attached the greatest importance to the following conditions and circumstances:

1. The strategic position of the carrier and the friendly relation with connecting railroads through mutual profit, which has brought to it a large present and prospective interchange of business.

2. The characteristics and conditions of the physical properties of the carriers and their operating efficiency.

3. The operation of the properties of the carrier and the going transportation concern with an established profitable business.

4. The development, both present and prospective, of the natural and agricultural resources of the territory directly served by the carrier, and the consequent commercial and industrial development therein.

5. The past, present and prospective gross revenue and net income of the carrier, and the stability of existing rates.

Mr. Loree placed a value of $80,000,000 on the property as an entirety. He thought the correct original cost to date of the property was in excess of $73,000,000, and believed the cost of reproduction of the property to be more than $82,000,000; but he held that the whole property was worth $80,000,000 regardless of the question of the amount of money originally put into the property, or whether the cost of reproduction was $70,000,000, $65,000,000 or $60,000,000.

"I think the intangible values," said Mr. Loree, "represent a sum of a series of relations which involve the strategic position, the resources of the territory served, the operating conditions, the conditions of the physical property, the organization and personnel and good will, and these cannot be allocated and a separate value given to any one of them." Mr. Loree thought that if proper allowance were made for items omitted from the Division of Valuation's tentative figures, the total for tangible items would be $75,600,000, which would leave the intangible value about $4,400,000.

Money expended in building up the carrier as a going business concern to the point of success, he thought, should be included in the intangible property. Assuming that the road had been laid down during the 24 hours of June 30, 1914, and had started in on July 1 to solicit its business, he thought it would have had about $3,000,000 of business local to the property; that it would have had to get, from the property and on the earnings of that year, $11,000,000. It would thus have had $8,000,000 to go out and find. It would have taken seven years to build up that earning—20% of it the first year, 30% the second year, 40% the third year, 50% the fourth year, 65% the fifth year, 85% the sixth year and 100% the seventh year; and estimating the cost of operating under that gross, and taking the interest on the investment, and offsetting that with the net earnings, an algebraic total something in excess of $14,000,000 would be obtained. Mr. Loree said he put it at $5,000,000, although he thought $14,000,000 much closer.

Five Considerations

Five considerations, Mr. Loree testified, influenced his judgment in reaching his figure of $80,000,000 for total value. They were original cost, cost of reproduction new, the value of the business as operated on what he considered a proper rate structure, the probability of increase in the business subsequent to June 30, 1914, and the annual turnover of the capital. Considering the probability of increase, he fixed the value of the property on that basis at $80,000,000, even though it was not then earning 6% on $80,000,000, because he conceived that the property, without substantial increases in its capital investment, was capable of handling a business of $18,000 a mile or about $16,000,000 in total, and that that would produce a net that would show 6% on more than $80,000,000, and would do that in four or five years. As to annual turnover, he said that investments in transportation enterprises usually show a turnover in from six to 6½ years. Assuming a gross earning of $15,000,000, a turnover in six years would show earnings on a valuation of $90,000,000. Taking all five of the methods, he felt warranted in assuming a total value of $80,000,000.

Mr. Kinnear gave $77,000,000 as his estimate of the fair total value of the property. In arriving at this figure he considered the extensive change of line and grade-reduction work done from 1909 to 1912, the original cost to date, the cost of reproduction new and cost of reproduction less depreciation, operating statistics, traffic conditions, competing lines and stocks and bonds. He, also, thought it not feasible to separate the tangible values from intangible values except by subtracting the sum of the tangible values from the total value.

Following are some of the things mentioned by him as contributing to the value of the property: Changes made in division points within the past few years, as a result of a careful study of operating conditions and the economic use, classification and distribution of power; the existence at division points of yards ample and in most cases of sufficient capacity to handle a marked increase in tonnage without additional tracks; liberal provision of team and industrial tracks and freight-house facilities, established as offering the utmost freedom for the care of increased business and future expansion; the terminals at Kansas City, with tracks exceptionally well located for the prompt handling and interchange of traffic with connecting lines, and for the switching of carload traffic to and from warehouses, industries and factories in the two cities, and with switching and classification yards conveniently located to insure prompt handling and grouping of interchange freight; in general, adequate and often rare judgment in providing for future growth; an efficient and well balanced organization.

Accumulative net income was used by Mr. Kinnear as a basis for forecasting future earnings. On this basis he estimated a net income of $5,200,000 for the year 1924. He thought this a very important factor in determining the total value of the property.

Comparisons with Competitors

C. E. Johnston, general manager of the Kansas City Southern Ry., mentioned as elements of value of the property the company's team tracks in Kansas City, which he regarded as the most conveniently located of any in the city; the small branch mileage; the natural location of the district terminals, which he said was "very favorable to the operation of the line, and enables you to handle your power and your trains and distribute your power to the greatest economy." He gave figures for the average mileage per car per day of cars on the Kansas City Southern, the Frisco and the Missouri Pacific. During 1910, before the result of the company's grade reductions was felt, the average car mileage on the Kansas City Southern was 23.6—less than for either of the other roads. In 1914 it was 29.5, more than for either of the others. In 1917 it had increased to 40.8. Similarly the average revenue train loading on the Kansas City Southern increased from 361 net tons in 1910 to 508 in 1914, while those of three competitors were much lower. He attributed these increases to the favorable condition as to balanced traffic.

Other figures given by Mr. Johnston compared the revenue tons carried one mile per mile of the Kansas City with the corresponding figure for three competitors; the ratio of operating expenses; the transportation expense per gross-ton mile; the average number of cars per train—and in each case he found the advan-

tage decidedly with his road. He also gave figures showing his road to have the shortest route to the Gulf of Mexico from Kansas City.

Mr. Davis' Summary

Mr. Davis gave $75,000,000 as his estimate of the total value of the property.

As to conditions affecting estimated value based on earning power, he had the following to say: "A well located necessary railroad has certain cardinal advantages which cannot be eliminated without materially reducing its values, which are:

"A. Its terminals. If it is a single line one of its terminals should be at an important deep-water ocean port and the other at an important inland concentration, storage and distribution center.

"B. Its intersections. It should intersect important trunk lines which serve as feeders from both directions and relieve the company from the maintaining of feeders.

"C. Its traffic. It should have a balanced traffic, the tonnage in one direction being approximately the same as the tonnage in the opposite direction, so that empty carrying capacity would be reduced to a minimum. The traffic should be balanced as to seasons, giving a high annual load factor.

"D. Its territory. The territory served should be rich in natural, developed and potential advantages, including (1) a variety of climate, insuring a variety of agricultural products and consequent traffic at all seasons; (2) important products, and of various kinds, well distributed along the line; (3) manufactures; (4) forests; (5) fertile soil; (6) freedom from snow, and (7) freedom from storms.

"E. Its physical characteristics. A successful railway is dependent also upon the extent, quality and efficiency of its physical equipment."

Cannot Separate Intangible from Tangible Value of the Railroad

As did the other witnesses, Mr. Davis said it was impossible to separate intangible value from tangible value.

"Some of the items of intangible value," said he, "are those relating to the past, the present and the potential connected or developed business as distinguished from and in addition to the bare bones of a physical property completed but not in use, and consist in the main of the following advantages: Excellent strategic location and a natural route of commerce with terminals connecting all important rail and ocean routes; good design, including economy, quality, practicability, size, adaptability and coördination of parts; great undeveloped sources of traffic; an excellent reputation with patrons and other carriers; efficiency of the transportation plant shown in part by (a) a relatively low operating ratio; (b) heavy train and car loading; (c) long hauls; (d) number of car miles per car per day; (e) dense traffic —compact operation without a multiplicity of branch lines, with more than 70% of its revenue derived from interchanged traffic; a well balanced north and south traffic; a well balanced interchange of traffic and a well balanced territory served."

Sinking of Levees Is a Problem in Louisiana

Increasing Trouble Demands Attention—Natural Elevation of Ground and Depths of Borrow Pits Are Factors

LEVEES on certain parts of the lower Mississippi River have developed a tendency to sink or subside, and within the past three or four years this trouble has reached proportions which call for precautions to prevent or minimize its recurrence. According to the recent report of the Board of State Engineers of Louisiana it is exceptional for the settlement of new levees to be limited to the amount which might be expected from natural shrinkage. This is the case especially below New Orleans. Observations indicate a relation between the natural elevation of the ground and the net height of levee which it will sustain. Thus, ground 5 ft. above Gulf level will carry a 9-ft. levee but not an 11-ft. levee. If the ground has an elevation of only 3 to 4 ft. it will barely sustain a levee 6 ft. high.

As the subsidence occurs mainly where levees have been built by machinery, it is thought to be due to the deeper borrow pits made by the machines. Assuming that under the foundation are strata of semi-liquid material, the excavation may either cut into them and cause them to flow into the pit or it may leave the solid bottom of the pit so thin that the soft strata can rise here and thus cause a subsidence of the adjacent embankment. Muck ditches near the center line of the levee contribute to the movement, even when their depth does not exceed 4 ft. Width of berm is another factor. In a levee having a berm 20 ft. wide in one part and 45 ft. in another the subsidence occurred only with the narrower berm.

Preventive Measures Advised

Preventive methods considered advisable for levees below New Orleans are as follows: Bottom of borrow pit not to be below Gulf level; muck ditch to be eliminated or located at or near the top of the slope; width of berm to be greater than in former practice.

Owing to the higher elevation and correspondingly greater bearing capacity of the ground above New Orleans, the trouble from subsidence was not encountered generally until new leveees began to be built behind the older ones and to the increased elevation as established by the Mississippi River Commission. With this increased height and the naturally lower elevation of the ground 500 to 600 ft. behind the old levee, the net height of the levee is increased 3 ft. to 4 ft. Thus, in the caving banks between New Orleans and Baton Rouge a net height of 20 to 21 ft. is the usual requirement, and above that point the height may be slightly greater.

The weight of an earth embankment of such height is given as 1800 to 2000 lb. per square foot for a width of 5 ft. on each side of the center line. That this does not exceed the theoretical safe supporting limit of the soil is evidenced by the stability of brick chimneys and other structures in the immediate neighborhood. The report points to influence of the borrow pits, as follows: "But Professor Rankine's safe load of 1½ to 1¾ tons per square foot, and Professor Baker's recom-

mended safe load of 1½ to 2 tons per square foot for ordinary clay foundations do not presuppose the presence of pits 10 ft. or more in depth within 200 ft. of the point of application of the load."

The conclusion is that deep borrow pits are responsible for subsidence along this part of the river also. This is supported by the fact that even the most obstinate cases of sinking levee have been corrected by loading the berm or the pit, after which the levee is brought to grade easily. This is a costly operation, however. Specifying shallow borrow pits also increases the cost of levees. As the problem is one that must be reckoned with in the future, it is important to determine the economical mean between these two costly methods of curing and of preventing the subsidence of new levees.

Rebuild Underdrains in Toledo Filters

PERFORATED pipes have replaced the strainer system originally placed in the filters of the Toledo purification plant described in *Engineering Record* of Nov. 26, 1910, p. 600. A report of the work done, as given in the annual report of R. W. Furman, chemist in charge, is as follows:

In June, 1916, Filter 5 was reconstructed, placed in operation and run continuously for experimental purposes. During the course of 1917 28 of the 34 filters were reconstructed after the manner of No. 5. The entire drainage, except the center manifold, was removed and replaced by pipe laterals, the bottom of which contained 16 holes spaced on 3¾-in. centers. At a distance of ¾ in. below the laterals a cement floor was placed. Around the laterals, to a depth of 3½ in., was placed assorted gravel with an approximate diameter of 1½ in. Over this were placed four 3-in. gravel layers. The air tubes were placed near the top and a little above the finest grade of gravel. The filter was finished with 24 in. of sand. A portion of the sand was new and of a fine grade, the original sand being of a grade too coarse for the best results. The resurfacing of these filters with a fine grade of sand, when finished, will bring the effective size down to about 0.35 mm. The old gravel was cleaned by being conveyed by an ejector to a system of screens for grading; there much time was saved by the use of a power shaker for distributing the gravel over the screens.

Owing to the fine character of the sediment in the settled or applied water, a very fine grade of sand can be used without reducing the period of service too much. The filters removed on an average 1.34% of the bacteria and 8.1% of the turbidity of the river water. The average number of bacteria applied to the filters was 390 per cc., and the average number contained in the effluent was 235 per cc. This number was reduced by disinfection to an average of 99 per cc. The B. coli index for the water delivered for consumption was 8.42 per 100 per cc. Disinfection was carried on for the greater part of the year.

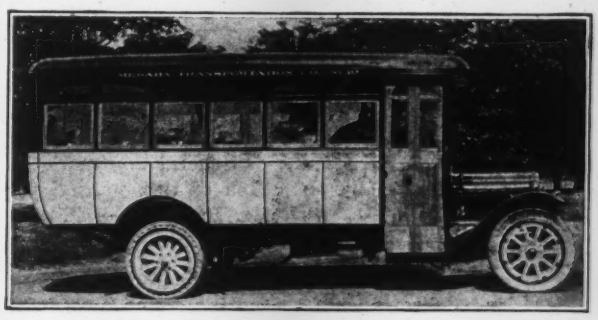
As a result of the softening treatment used during the previous year, the incrustation on the sand and gravel caused an increase in the total hardness of the filtered water during the times when alum was used as a coagulant. The alkalinity of the effluent was also increased and consequently the calcium and magnesium content of the water.

For the entire month of September the river water was found to abound in algae and microscopic organisms that reduced the period of service of the filters to an average of 20 hours. During this time there was used 1.99% of wash water, the highest percentage used during the year. Much wash water was saved during this month by introducing enough water to break the surface of the sand without allowing the water to waste.

Fifty-Mile Motor Interurban Service Operated

Buses in Minnesota Run on Regular Schedules—Fares Are Not Greater Than Ordinarily Charged by Railroads

LONG-DISTANCE motor-bus routes are a feature of transportation methods in Minnesota, according to the annual report of the State Highway Commission. Inquiry by *Engineering News-Record* shows that a typical route is that operated by the Mesaba Transportation Co. between Hibbing and Grand Rapids, a distance of 50 miles. The company has regular printed schedules which list six round trips each day. The



BUS USED FOR FIFTY-MILE PASSENGER INTERURBAN SERVICE TRAVELS ON COUNTRY ROADS

running time is three hours, with 15 intermediate stops, and the fare is $1.50 each way. This rate of 3c. per mile is very close to railroad tariffs.

Service to various points within 50 miles of Hibbing is operated by 18 motor-buses of 30 hp. each. For the main run to Grand Rapids, with a good gravel road all the way, ¾-ton machines are used, each making 100 miles daily. For other routes, with earth and paved roads, 1½-ton machines are used. The service has been in operation for five years, and the company states that no great difficulties have been experienced from bad weather or poor roads. No serious delays have been caused by snowstorms, a small snow plow having been built on a 45-hp. 1½-ton bus.

All these motor buses are made by the White Co., the ¾-ton and 1½-ton cars seating 12 and 22 passengers respectively. Provision is made for parcels and light baggage, but no freight is handled. Pneumatic tires 32 x 6 in. are used, and the operating speed is from 15 to 25 miles per hour.

A 160-mile route from Walker to Sauk Center is mentioned in the highway commission's report, but this

line has been discontinued as the local traffic proved insufficient.

In the opinion of John H. Mullen, engineer and deputy commissioner of highways, the additional highway maintenance cost, resulting from traffic of this kind, should be taken care of by special license for the vehicles. At the present time, Minnesota has no commercial vehicle law which authorizes the collecting of funds from truck companies to pay these extra charges.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Owners Need Education in Contract Practice

Sir—I have read with much interest the articles in your issues of July 18 and 25, regarding new forms of contracts. Allow me to call your attention to the fact that it is the owners that require education. As a rule, they do not offer any inducement to a contractor to do good work, as they invariably award the work to the lowest bidder without regard to his qualifications, other than that he can furnish the required bond. I have 35 years' experience and have worked in many of the states, and this rule with few exceptions I have always found in force. The strongest corporations are generally the worst sinners.

Pittsburgh, Pa. WALTER F. PATTERSON,
General Contractor.

[As stated editorially on p. 159 of this journal for July 25, it fully agrees with Mr. Patterson.—Editor.]

Endurance of Concrete Ships

Sir—Your editorial in *Engineering News-Record* for July 11 *in re* the endurance of concrete ships brought to the writer a sense of disappointment, all the more keen for the anticipation with which its appearance had been awaited. At this time of all others definite, authoritative word on this important subject is particularly needed, yet your editorial mainly concerned itself not with the ostensible thesis as to the performance of concrete in sea water, but rather with the question of whether or not Mr. Wig said or did not say, as reported, that concrete ships would disintegrate in from one to three years' time—a question (aside from the wish to see justice done in all things and to all men) having as much effect on concrete hulls as that which raged in the press of England some five years ago as to whether or not Mrs. Pat Campbell actually did or did not say "bloody" at her initial appearance in Shaw's "Pygmalion."

But aside from accuracy or inaccuracy of statement or quotation, this editorial offers neither affirmation nor denial as to the endurance of concrete in water. Carbonated protective coatings on the surface of concrete are mentioned, as mitigators of sea water attacks, together with the danger of rupturing such coatings. "Revetments of carpentry," to quote from Gillmore, more than 70 years ago, are also mentioned in the same connection and for the same protective purpose, under the newer name of wood lagging.

Density is mentioned, it is true, but the mention put forward this quality not as the true crux of the question but hesitatingly, as partaking of an unattainable perfection, for lack of which panaceas such as carbonated coatings *et al.* are resorted to. Bitumen paints, as ancient as the command of Jehovah to Noah, "Thou shalt make thee an ark of gopher wood and pitch it within and without," are revamped for the same protective purpose.

Yet, granted a bump or a scrape sufficient to pierce either carbonated coat or Father Noah's pitch, the inference from this editorial is inescapable that sooner or later the proud concrete ship must become a heap of ignominious mush, carrying with her to her sulphated grave all men and things on board.

If this be true, must not insurance rates on concrete hulls be at a premium? And may we not expect to see in such policies a clause exempting the insurer from liability "on account of logs, porpoises, whales or other abrading causes" as certain policies in other fields now carry release from liability for destruction through "acts of God?" And may we not learn of some Admiral Percival crying "Damn the torpedoes!" yet, after bumping a floating timber, supplicating Heaven at the cry of a chemist in the bilge: "SO_2 radicals eating the port bow!"

Foolishness? Of course this is foolishness, but logical foolishness, granting the premises on which your editorial rests.

Like the recorder of the "Yarn of the Nancy Bell" I confess that: "It is little I know of lives of men of the sea, but I'll eat my hand if I understand" . . . how any decently good concrete can be expected to behave in this manner.

But, though no sailor, I do know concrete, good, poor, and bad. *All concrete problems are basically problems of good concrete;* and the concrete ship problem is *superlatively* a problem in good concrete. Density (in terms of negligible porosity or absorption) and high strength—almost correlative terms, carrying with them the added values of low mass and correspondingly lessened weight—are the critical qualities to be sought. If absorption and permeability are negligible, disintegration, either in salt water or in fresh water, will be negligible, for it takes, literally, millions on millions of gallons of sea water to sulphate even so much as one-third of a cubic yard of concrete; and obviously the supply to the interior must be constantly renewed for continued action. To realize this latter condition requires passages for water, which means porous concrete. But with such admittance of water, the binder of concrete will dissolve or disintegrate beneath any coating; and iron will rust, just as it has since the beginning of time on contact with moisture and oxygen. "Revetments of carpentry" may hold the softened mass in place so that its state is not outwardly visible, but be sure, if concrete is porous, that decay will go on.

With full appreciation of the magnitude of the task of producing concrete of requisite quality, uniformity and strength throughout a hull, I desire to say again that the ship problem, like all problems in concrete, is first and last and fundamentally a problem of producing

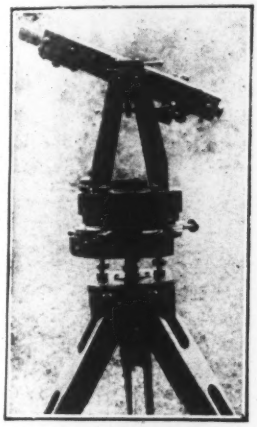
and placing the very best concrete that can be made. Stresses may be analyzed with the greatest care, yet if any part of the concrete, as by the multiphased evil of porosity, falls below the assumed unit strength, the best design can be rendered useless, no less than if the reinforcing bars failed.

Are ship plates of steel made from uncropped or faulty ingots? "Do men grow dates of thorns or figs of thistles?" Concrete hulls will or will not endure not because of any fiat pro or con, but according as to whether or not man in their building has conformed to or disregarded those inexorable natural laws which govern all things in the universe.

New York City. NATHAN C. JOHNSON.

Home-Made Transit Built Mostly of Wood

Sir—Inclosed is a snapshot of a home-made transit made by Fred J. Meyer, Chehalis, Wash. The tripod is of the split-leg type, made of cedar. The plumb bob is made from a 38-caliber revolver shell with a hole drilled for the string and soldered to an old spray nozzle, all topping a lead casting of special design. The bearing plate for the foot screws is a solid piece of 1½-in. fir, bolted through to prevent warping. The bearings for the foot screws are made of wood lined with part of a 12-gage shotgun shell. The instrument has a ball-and-socket shifting head.



The one horizontal motion is attached to an old balance wheel from a sewing machine. This wheel serves to prevent warping of the plate, which is a solid piece of fir, 1½ in. thick, of octagonal shape, 7 in. across. However, this wheel has the bad effect of attracting the needle of the compass, making a difference of about 5½°. The horizontal circle is made from an 8-in. celluloid circle, graduated to ½°, marked as usual from 0 to 360° and in quadrants.

One unusual feature of the horizontal motion is the method of reading angles. Since the transit is used mostly for producing lines in subdividing sections, only small angles are used in avoiding trees, etc. In the work the motion is clamped, a tangent screw brings the cross hair on the backsight, and the telescope is plunged. Then if an object is in the line of sight, a divided arc, independent of the motion, is shifted the required angle from the zero of the horizontal circle. Then the zero of the circle is brought to the zero of the independent arc, thus measuring the angle. This independent arc was made from an old piece of celluloid comb and has its own tangent screw.

There are two plate levels and a 1¾-in. compass. A cap from a dry-cell battery was made use of in the mechanism to lift the needle. The center bearing is made up of a ½-in. gaspipe filled with babbitt metal and then drilled out to receive the solid steel spindle. The standards are of one-piece fir, 1 in. thick and substantially braced with four brackets.

The telescope is 14½ in. long, made up of small lenses from an old telescope, all contained in a 2-in. square piece of hollowed oak. It has a ⅞-in. object glass focused with a home-made rack and pinion. The attached level, like the plate levels, is of the ordinary carpenter's level size, and protected by a wooden case. A tangent screw is attached for leveling work, which has been done with an error of only ¼ in. in a ¼-mile circuit.

Most difficulty was found in putting in the spider-web cross hairs, the eighteenth attempt being successful. The centering of the horizontal circle and the instrument was also one of the hard parts of the work.

To make the instrument as nearly waterproof as possible, all of the wood was dried thoroughly before being used, after which four coats of black paint, two of varnish, three of bronze and two of lacquer, were applied.

Mr. Meyer states that the instrument gives very good results in double centering, and has shown no bad effects from use in the rain.

The total cost for material was $10 and the instrument is valued at $75.

Bellingham, Wash. W. G. PETERS.

How Can Organic Matter Be Removed from Concrete Sand?

Sir—I should be pleased to know whether any readers of *Engineering News-Record* have had successful experience in treating sand that contains a high percentage of organic matter so that the organic matter is neutralized to such an extent as to warrant the use of such sand in high-grade concrete masonry.

The County of McDowell has had considerable highway and bridge work, using sand from outside this state, but on account of the great demand on transportation it is becoming more difficult to get outside sand and sometimes impossible. There is an abundance of local sand, which according to the standard calorimetric test for organic impurities cannot be used in concrete work on account of organic matter. There is a universal complaint in this region that concrete made with local sand deteriorates, and I might say that in many cases it absolutely disintegrates in from seven to fifteen years. The presence of the organic matter may be responsible for this trouble.

I have been experimenting with local sand and slaked lime, using ten per cent. of the lime by weight with sand thoroughly mixed dry. The reaction from the sand thus treated is entirely satisfactory according to the test for organic matter. Apparently, there is a large percentage of tannic acid in this sand, which is neutralized by the lime. There are other organic acids, which it would require the work of a chemist to determine.

The question that I would like to have answered is whether the sand treated with lime in this way will be safe to use in high-grade concrete work. It may be that some future chemical reaction would cause disintegration of the concrete and reinforcing rods.

It may be that this sand can be burned and the organic matter thus eliminated. I would like to know if any of your readers has any suggestion in regard to this proposition. I would also be glad to know if there is any other suggestion for treating this sand, which

will make it safe and economical to use it in concrete. The grains of sand examined under a low-power magnifying glass appear to be clean. There are small particles of wood and bark in the sand; a large percentage of this is removed by screening. The test for organic matter with this screened sand is altogether changed for the better.

I have made tests for organic impurities in sand found at many points in this county, and while they are not complete, they seem to indicate that the sand taken from the bottom of streams is very much better than that taken from the deposits along the shore. I found some sand in the bottom of the stream in which there was a large percentage of coal, that gave an entirely satisfactory test otherwise. S. A. WHITE,

Assistant Engineer, County of McDowell, West Virginia.

Welch, W. Va.

Separate Deterioration of Highways Due to Weather and Traffic

Sir—Your issue of Apr. 18 contains an article of more than usual interest dealing with the cost of highway maintenance, contributed by H. G. Shirley, chief engineer of the Maryland State Roads Commission. This contribution deserves more than passing notice, because it treats of a subject about which there is a serious lack of reliable and exact information, and because it leads to a conclusion at variance with your editorial comment on the article. Your comment sets forth a viewpoint that needs a wider recognition.

The writer hoped that other highway engineers, who have made similar observations and investigations, would discuss Mr. Shirley's article before this. The cost of maintenance is an important factor in the economic theory of highway transportation, and it is highly desirable that data be collected and made available to the engineering profession. These data should lead to the determination of the quantitative relation between the annual cost of maintenance for each type of pavement and the density of traffic carried thereon. As a preliminary to this accomplishment, it is necessary to segregate the data relating strictly to wear due to traffic from those relating to deterioration due to climatic conditions and variations in the weather. To confuse these two groups of data is not conducive to clear and accurate thinking.

Although the chart presented by Mr. Shirley would make it appear that the cost per ton mile for maintenance is a function of the tonnage, yet the shape of the curves, as shown, indicates that other factors than tonnage of traffic are affecting the cost per ton mile. What would become of the curves when the tonnage factor reduces to zero? That other factors are included is shown by the text, which cites an instance of heavy rains causing washouts and thereby increasing the maintenance cost for a road having very little traffic. If Mr. Shirley could separate the deteriorating effect of the weather factor from the wear due to traffic, a distinct step in advance would be made, because then the cost of maintenance, due strictly to the tonnage variable, could be stated in terms of that variable.

Again, it is difficult to see why a ton of traffic at the end of the day should cause a higher unit cost per ton mile than a similar ton of traffic at the beginning of the day. It is conceivable that the cost of maintenance per square yard should increase as the tonnage factor increases, but it would seem to the writer that with a suitable pavement, the wear would be the same for any particular ton of the total tonnage as for any other similar ton of that same total tonnage, unless the weather or temperature changed. In other words, there should be no progressive and cumulative deterioration of pavement due solely to the traffic tonnage. The unit cost per ton mile should remain constant, unless the type of pavement is unsuited for the traffic.

To have a minimum point in the unit cost curve is to invite a curtailment of traffic, which is in direct conflict with the purpose of the highway as the writer sees it. This point of view is aptly expressed in your editorial previously mentioned. We should look for an economical pavement rather than an "economical traffic."

If Mr. Shirley could give us the cost data in such form—and this seems possible because his article indicates that considerable care has been taken to measure the wear due to traffic—that the wear due to tonnage could be separated from the deterioration due to weather variations for particular types of pavements, it would become possible to state the annual cost of maintenance per square yard for a selected type of pavement as a function of tonnage or density of traffic.

It is to be hoped that a continuation of Mr. Shirley's article will appear in your columns.

R. C. BARNETT,

Missouri State Highway Department.

Jefferson City, Mo.

[This letter was submitted to Mr. Shirley, whose reply follows.—Editor.]

Sir—Mr. Barnett's analysis of the subject, I believe, is very clear. It is true that there is a certain cost, which I have termed "climatic cost," that is chargeable to any road whether it has traffic over it or not, and this cost varies largely with the different types of surfacing. The cost on some surfacing is greater than on others, and there are some types of pavement that require a certain amount of traffic to keep them rolled down and well sealed up, while others do not require traffic and do not deteriorate on account of weather.

It would be very hard to segregate the cost of deterioration due to climatic conditions from the actual wear and tear. When you consider the shoulders this cost varies with the character and condition of the soil; some soils being more capable of withstanding wash and heavy traffic than others.

Regarding the studies I made in Maryland, I did not go into enough detail to obtain the data accurately, and I am therefore reluctant to give it to the public. I believe it is possible to obtain such data, and the paper on my studies in Maryland was intended to bring this before the engineers of the country, being something to start with more than anything else.

I know this is a vital subject, and I would like to see it gone into a great deal more in detail. Of course, certain facts could be derived from the studies we made that would be an indication of the actual condition, but not having these before me at present, I am unable to give you the benefit of what this segregation would show. H. G. SHIRLEY,

Secretary, Highway Industries Association.

Washington, D. C.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Gravitation and Two Men Operate Side-Hill Mixing Plant

By JOHN T. SULLIVAN
Covington, Ky.

SUCCESSFUL adaptation of local topography to plant location is exemplified by the Cincinnati East Side High School concrete mixing plant. A ravine traversed the building site, and a materials spur from the nearby railway was carried across this ravine close alongside the wall of one of the principal buildings. By a trestle and a little grading at the ravine crossing a mixing plant charged by gravity and requiring very little structural work was obtained. The drawings show the arrangement. A wooden wall was erected across the ravine to form the front of the bins, and the bottom was lined with boards which were laid on the sloping grade of the ground. A partition wall was erected to keep the crushed stone and sand separate. The stone and sand were shipped in cars having drop-bottom gates. The cement shed was located on one side of the ravine and was erected so that the floor of the shed was on the same elevation as the track. It was built in this way to make use of a roller conveyor for transporting the cement from the car to the shed. Another advantage gained was that when the cement had been stacked about 5 ft. high over the entire floor of the shed the conveyor was abandoned, a runboard was placed on a level from the car to the top of the pile and a second 5 ft. course was started. This eliminated high lifting in stacking the cement.

What Are You Doing to Help Win the War?

Buying W. S. S.? Oh, yes.

Paying your taxes? Oh, yes, of course.

Working your head off to make sure YOUR *job won't delay the game? Well, naturally.*

Thinking up new stunts every day to beat the best you ever did before?—so our boys will get the stuff to push the big scrap back across the Rhine? You bet!

But—are you helping the fellows on the other war jobs beat the Kaiser to it by telling what YOU *put across—in*

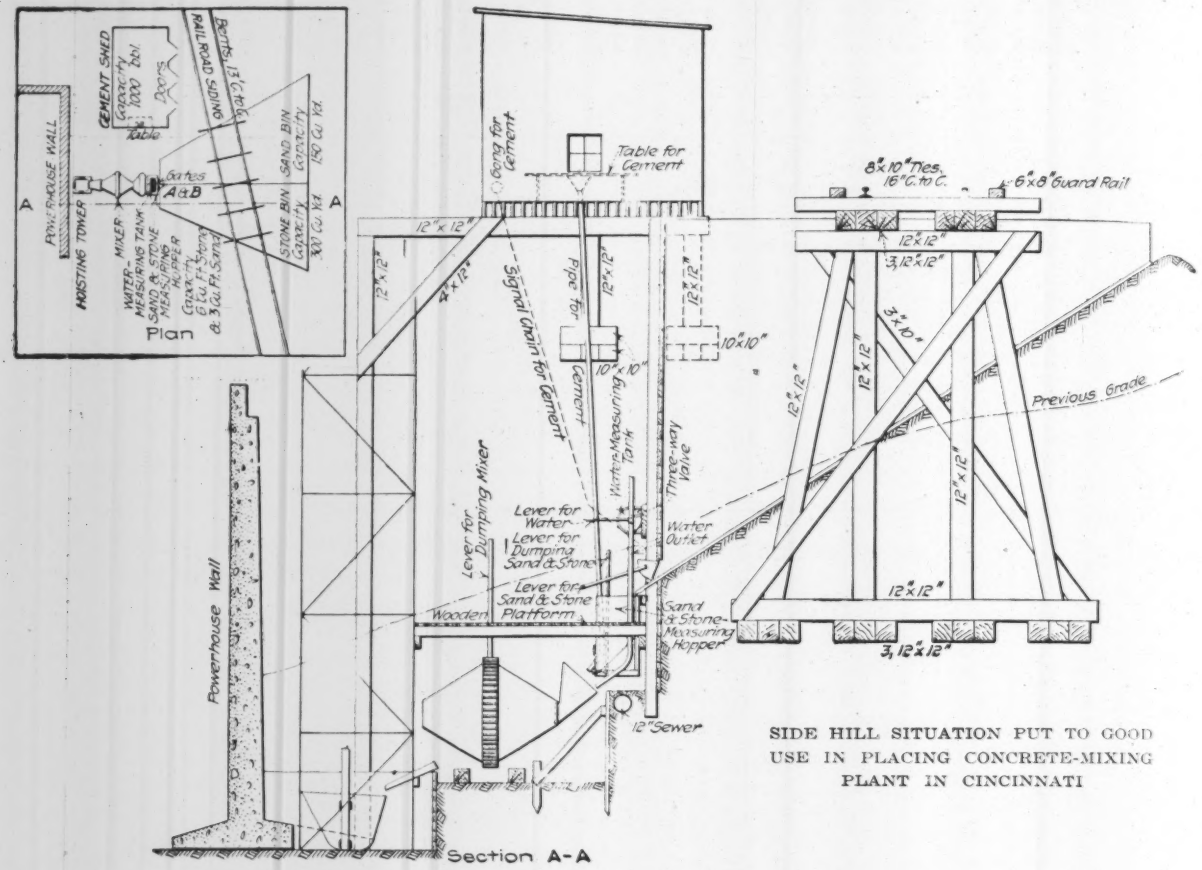
HINTS FOR THE CONTRACTOR?

The excavation for this plant was extraordinarily small, due to the advantage taken of the natural ravine and to the extra excavation which was required for the broad footings of the power house walls. The previous grade of the deepest part of the ravine and also the extent of the necessary excavation for the power house walls are shown by the drawing of the mixing plant (next page). It can be seen that little dirt had to be removed to set the mixer in its proper low position. The entire pit was drained through the power house sewer.

The procedure of mixing a batch of concrete was as follows: A man standing on the wooden platform above the mixer opened the gates A and B. These gates were in the same line in elevation and were situated in the front wall of the bins and on each side of and close up against the partition wall, which separated the crushed stone and sand. The stone and sand trickled through the gates and dropped into a steel measuring hopper as shown by the drawing of the mixing plant. This measuring hopper had a partition wall to separate the stone and sand and held 6 cu.ft. of stone and 4 cu.ft. of sand. The measuring hopper was filled to a mark indicating 4 cu.ft. of stone and 2 cu.ft. of sand, and the gates A and B were then closed. The lever C was then pushed back toward the bins. This raised the small arm at the bottom of the lever C. This small arm was rigidly fastened to the lever and passed over a lug on the hinged gate of the measuring hopper, and in this way held the gate closed. By pushing the lever C back the small arm raised sufficiently to clear the lug and cause the gate of the measuring hopper to open and the contents to drop into the mixer. Lever C was then pulled back to the original position and the measuring hopper gate closed. The rope D was pulled and rang a gong in the cement shed. A man standing in the cement shed proceeded to dump the contents of two sacks of cement into a funnel which was built into the top of a table at the window as shown on the drawing. This table was large enough for the man who handled the cement to have about eight sacks lined up in reserve. The cement traveled from the funnel through a 4-in. down-spout pipe to the mixer, where it was discharged.

The man on the platform proceeded to repeat the process with the levers A and B and to fill the measuring hopper again. The operation of lever C was repeated and the mixer then contained a full charge of stone, sand and cement, for a 1:2:4 mix.

The lever E was then pulled down through 90 degrees. This lever was attached to a three-way valve which operated so that when the lever E was in a horizontal position the water came down through the water line and flowed into and filled a steel tank. This tank could be regulated so as to hold just the proper amount of water required for a batch of concrete. While the lever E was in the horizontal position the water could get into the tank but could not get out through the pipe leading to the mixer. When the lever E was pulled down through 90 deg. the water was thereby shut off from flowing from the water line into



SIDE HILL SITUATION PUT TO GOOD USE IN PLACING CONCRETE-MIXING PLANT IN CINCINNATI

the tank, but at the same time a pass was opened for the water, which was in the tank, to drain through the pipe leading to the mixer.

After the water had been added the man on the platform operated the lever F and dumped the batch into the bucket, by which it was hoisted and then distributed by chute to the required place.

The contractors for the work were Roos Bros. Construction Co., Cincinnati, Ohio.

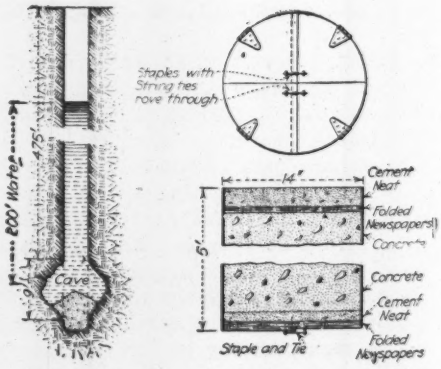
Easy Way of Locking Steel Nuts

A SUCCESSFUL method of locking angler steel nuts is to saw slots in them and then drive the edges of the slot together. The slot should be cut at one of the angles of the nut, at right angles to the bolt, and should extend in nearly to the bolt. When the slot is sawed it is closed up sufficiently with a hammer and chisel to distort the threads and lock the nut. The method was described in a recent issue of *Coal Age*.

Bottom-Dump Bucket Concretes Cave in Drilled Well

A DANGEROUS cave 475 ft. down in a drilled well was recently successfully concreted by the Whitney Well Co., Chicago, by means of an improvised drop-bottom bucket. The bucket consisted of a 5 ft. length of pipe of 13¼-in. inside diameter with a ⅜-in. shell. To the bottom of this pipe were hinged four quarter sector doors. As indicated by the sketch, two of these doors on one side overlapped the two doors on the opposite side.

The four doors were held closed by string ties rove through staples. When open they left clear the full diameter of the bucket. In operation the doors were closed and fastened. Then a layer of folded newspapers was placed inside on the bottom and on this mattress



CAVING IN DEEP WELL STOPPED WITH CONCRETE PLUG. HOW THE PLUG WAS MADE

a bag of cement was spread. The bucket was then filled to near the top with a dry mix of 1:1:2 concrete using ¾-in. stone. On top of the concrete was placed another layer of newspapers covered with a bag of cement.

The ties which secured the doors were made just strong enough to hold the charge of concrete when the bucket was handled gently; they would break if the bucket were given a jerk. The purpose of the newspapers and neat cement waddings was to keep out the water during the time required to lower the bucket to the cave. About 200 ft. of water had to be passed through. After the bucket was filled it was allowed to stand until the concrete took an initial set. It was then lowered by the well rig until it touched bottom at the cave and then was lifted with a jerk which broke the door ties and let the partially set concrete flow out into the cavity. A total of 130 sacks of cement was required to fill the cave. When the concrete had set, drilling was resumed without any further trouble from caving.

Other Articles In This Issue of Interest to Contractors

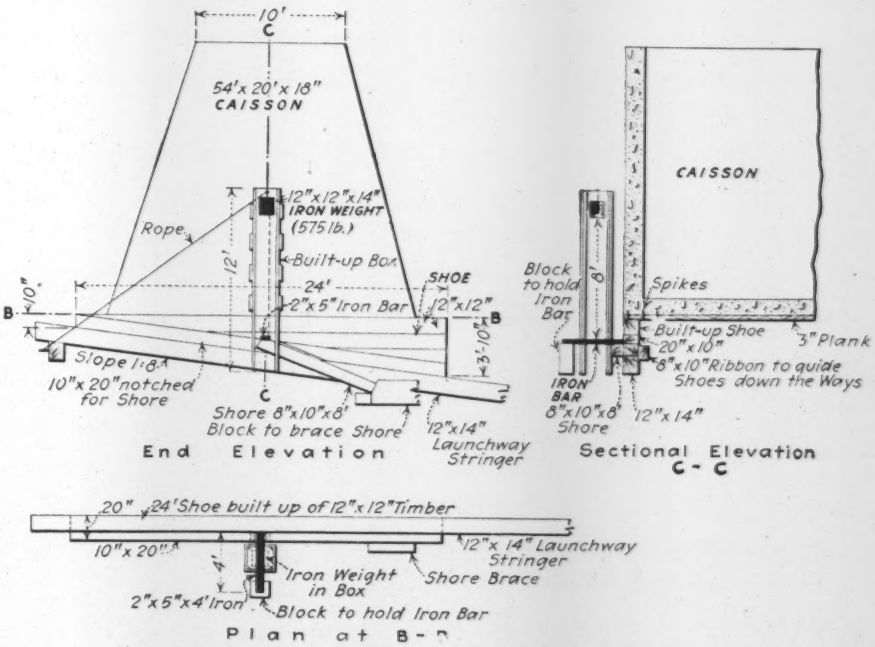
Concrete Cassion of New Type Used in Breakwater	Page 258
Lukewarm Concrete Enough Precaution for Zero Weather Dam Work	Page 260
Gas Troubles Delay Tunnel	Page 262
Molten Slag Is Hauled by Rail for Making Embankment	Page 267
Owners Need Education in Contract Practice (Letter)	Page 282

Launch Concrete Caissons Like Ships

SHIPBUILDING practice is followed in the launching of hollow reinforced-concrete caissons which are built at Milwaukee, for harbor work on Lake Michigan. Caissons of 500 tons weight for the Racine breakwater, now under construction, are 54 x 10 ft. on top, with sides sloping 3 on 1 and a vertical height of 21 ft. 3 in., as described on p. 257 of this issue. A 3-in. plank platform constitutes the bottom of the form and becomes a permanent part of the caisson, being bonded to the concrete bottom by projecting spikes. As shown in the drawing herewith, this platform is supported by blocking on shoes which rest on the inclined launchway stringers, there being four launchways to each 54-ft. caisson. Each of the two outer shoes is held against sliding by an inclined shore which has its lower end butted against a heavy block and its upper end against a timber on the outside of the shoe. By knocking away the shores the shoes are left free to slide, carrying the caisson into the water. The launchways are extended to such a depth that the caisson will float free without dropping or plunging. Simultaneous release of the two shares is necessary to avoid any tendency of the caisson to slew if one end should start first. For this purpose an iron block is suspended over each shore by a rope which extends across the rear of the caisson and has a ring at the free end. The two rings are connected by a short length of rope, as shown, and when this is cut the two weights fall 8 ft. and knock out the shores. They do not strike the latter directly, but strike an iron bar which has one end resting on the shore and the other on a fixed block. Each block weighs 575 lb. and is inclosed in a plank box.

PLAN OF ROPE CONNECTIONS OF WEIGHTS WHICH RELEASE THE CAISSON

The ways have a slope of 1 in 8. They are greased before the launching, but usually the caisson will not start without an impulse being given by means of horizontal jacks. This method of launching proves very satisfactory. The construction of these caissons is done



LAUNCHING PLANT FOR CONCRETE CAISSONS

by day labor at a yard established for the purpose and is under the direction of J. A. B. Tompkins, district engineer of the United States Engineer Office, Milwaukee.

Shovel on Road Job Dumps Concrete Mixed at Quarry Plant

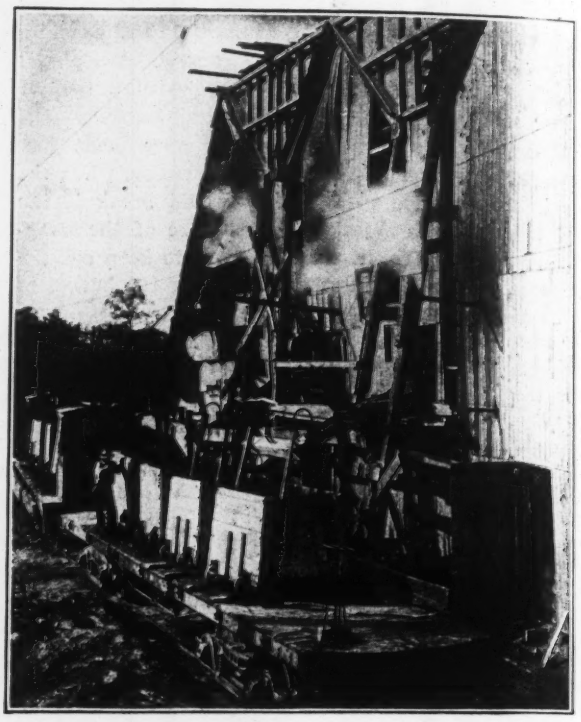
By E. L. Sparks
New England Representative, Erie Steam Shovel Co., Erie, Penn.

BY MAKING its revolving steam shovel do double duty and dump the concrete buckets after it had graded the road, the Sperry Engineering Co., New Haven, Conn., was able to mix its concrete on a recent state highway section at a central plant. The handling of material was minimized by locating this plant at the quarry which supplied the aggregate. The electric railway which parallels the road was used to haul the concrete.

The Connecticut Quarries Co. operates a trap rock quarry directly on the state highway from New Haven to Hartford at Mount Carmel. The road job in question is a 7-mile stretch from Mount Carmel to Cheshire. It is paralleled by a double-track trolley line.

Rock is conveyed directly from the crusher to the bins above the mixing plant by belt conveyor. Concrete is delivered to 1½-yd. timber skips which are carried on standard-gage flat-cars handled by standard-gage electric motor cars furnished by the trolley company. Two flats, one of them a motor car, carry eight skips, or 12 cu. yd. of concrete to the train. The concrete work train has to keep clear of traffic, but cars are only operated in one direction at half-hour intervals and there are frequent passing tracks.

Arriving at the front, the revolving shovel which excavated the subgrade is utilized to unload and place the concrete. Stripped of the dipper, the shovel drops its dipper stick, picks up each skip and quickly distributes the concrete. The propelling motion of the steam shovel is brought into play to place the concrete exactly where wanted.



CONCRETE HAULED FROM CENTRAL PLANT AT QUARRY

As an evidence that this long haul for concrete is proving economical, the Sperry Engineering Co. reports that an average day's run of 10 hours on this 18-ft. road of 7-in. concrete amounts to 400 feet.

SHOVEL WITH DIPPER REMOVED DUMPED CONCRETE JUST WHERE IT WAS WANTED

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Open H System of New York City Transit Lines

Trunk Subways Now in Operation—River Tunnels and Brooklyn Lines to Be Completed

Through the opening of the H section of the dual subway system in New York City on the evening of Aug. 1, all of the trunk subway lines in Manhattan and the Bronx and all of the new Brooklyn lines connected to Manhattan by bridge have been placed in operation. None of the new East River tunnels have yet been opened, nor have the Flatbush Ave. and Eastern Parkway subways in Brooklyn. The guests invited to the opening saw the final spikes in the connection to the Lexington Ave. line at the Grand Central station driven by George H. Pegram, and D. L. Turner, chief engineers of the Interborough Rapid Transit Co. and of the Public Service Commission. The party proceeded by special train to South Ferry, returning up the new Seventh Ave. subway to Times Square and proceeding to the Astor Hotel, where appropriate addresses were delivered by John F. Hylan, mayor of New York, T. P. Shonts, president of the Interborough company and others, Charles B. Hubbell, chairman of the Public Service Commission, presiding at the ceremony.

D. L. TURNER AND GEORGE H. PEGRAM (WITH MAULS, FORMER AT LEFT) DROVE LAST SPIKES IN H SUBWAY TRACK CONNECTIONS

The new system is formed by extending the old upper Broadway subway down Seventh Ave. from Times Square and the old Park Ave. subway on the East side up Lexington Ave. from Grand Central Terminal. Through operation on the 42nd St. portion of the old subway is discontinued and independent north-south through operation of the Seventh Ave.-Broadway line on the west side and the Park Ave.-Lexington Ave. line on the east side of the city established.

Express service was discontinued at 8:45 p.m. and was not resumed until the following morning, by which time all track connections were completed. Local service was diverted with a maximum delay of 17 minutes, which was the length of time the first north-bound local on the Seventh Ave. line was held at Times Square while the old express and southbound local tracks in the Times Square curve were removed and the new track laid. At Grand Central no delay occurred, north-bound locals being run on the express track, and the north-bound local turnout being put in at leisure. The other three tracks have been connected to the old tracks by switches for some time past, the grade of the turnouts making this possible for all but the east one.

The new line of the New York Municipal Co. on lower Broadway having been opened, in successive stages, from

Continued on page 290

First Launchings at Bristol and Hog Island

Ship Production Initiated at Two Large Yards—"Watonwan" Sticks on Ways at Bristol

Fabricated-ship construction advanced to a new stage during the past week through the entry of Bristol and Hog Island into ship production. The two yards, both agency enterprises of the Emergency Fleet Corporation, celebrated their first launchings Aug. 3 and Aug. 5, respectively. Bristol's first hull, the "Watonwan," unfortunately stuck on the ways, through a cause not yet explained, and at the time of going to press had not yet been moved. At Hog Island, on the other hand, the "Quistconck" slipped down the ways without incident, in harmony with the good record made in Emergency Fleet launchings hitherto. The occasion was distinguished by the presence of President Wilson and of Mrs. Wilson, who christened the ship.

Vessels of 9000 tons dead-weight capacity are being built on 12 ways at Bristol by the Merchant Shipbuilding Corporation, of parts fabricated in the bridge shops of the American Bridge Co. (85%) and in the corporation's shop at the yard (15%). The present orders are for 60 ships, all of the same size and type. The Hog Island yard of the American International Shipbuilding Corporation, with 50 shipways, is carrying out an order for 120 vessels of 7500 tons and 60 of 8800 tons capacity, of cargo and transport types, respectively. Only the smaller type has been put on the ways up to the present. The yard does assembly work exclusively, all hull parts being fabricated in bridge and plate shops scattered throughout a large section of the United States; more than sixty such shops are now engaged in this fabrication.

Work progressed at both yards closely in accord with schedules planned out months ago, and the launching dates fixed long previously could be held to. No difficulties in assemblying the fabricated parts were reported, although adjustment of molds and minor modification of erection procedure are expected to facilitate construction of the subsequent vessels.

Denver Votes to Buy Water-Works

By a large majority the taxpayers of Denver, Colo., voted on Aug. 6 to issue $13,970,000 of bonds to buy the property of the Denver Union Water Co. in accordance with an agreement already reached.

Open H System of New York City Transit Lines

(Concluded from p. 289)

Times Square to lower Manhattan, all of the Manhattan and Bronx trunk lines are now in operation, but are not yet connected to the Brooklyn and Queens lines by the new tunnels under the East River, of which four pairs are being built. Connections to the Fourth Ave. (Brooklyn) subway over the Manhattan bridge and to the two elevated

DATE OF OPENING PRINCIPAL LINES OF DUAL SYSTEM

Center Street Loop (B.R.T.) Subway, Brooklyn Bridge to Williamsburg Bridge and Broadway Elevated in Brooklyn	Aug. 4, 1913
Steinway Tunnel (Interborough)	June 22, 1915
Fourth Avenue Subway (B.R.T.)	June 22, 1915
New Utrecht Avenue Elevated Branch of 4th Avenue Subway	1916
Fourth Avenue Subway Extension (B.R.T.) from 65th Street to 85th Street, Brooklyn	1916
White Plains Road Extension of West Farms Branch of old subway (Interborough)	1917
Jerome Avenue Branch of Lexington Ave. Subway (Interborough)	June 2, 1917
Seventh Avenue Subway (Interborough)	June, 1918
Lexington Avenue Subway (Interborough)	July, 1918
Operation of H System	Aug. 1, 1918

lines in Queens via the 42nd St. tunnel and the Queensborough bridge, have been in operation for some time.

In spite of ample newspaper notification of the change, and partly, it is alleged, because the change was made in the middle of the week, thousands of persons arriving at the Grand Central and Times Square stations attempted to follow the crosstown route of the old subway under 42nd St. The crowds swamped the shuttle service on the old line and caused what is referred to as the most serious subway blockade New York has ever seen, requiring some hours' work on the part of police reserves before the difficulty could be untangled.

As a result, the shuttle service was ordered discontinued entirely, the object being, according to the Public Service Commission, to force the public to learn the new system, which provides more direct routes for the public in most cases than the old. When this result has been accomplished, it is stated, the shuttle service under 42nd St. will be restored as originally planned.

McAdoo's Approval Necessary for Assessments Against Railroads

Approval in advance by the railroad administration is required wherever street or road construction or other public improvements are contemplated by the authorities in any state, county, district or municipality, for which $500 is to be charged against any railroad under Federal control, according to a circular issued July 29 by the Director General of Railroads. Otherwise the Director General will reserve the right to decide whether or not he will participate in the payment.

"It is not the attitude of the Director General," states the circular, "to oppose construction of this character which is meritorious and essential."

Declares Garbage Reduction Works a Nuisance

Odors from New York City Scows and Plant Detected at Distance by State Health Engineers

Field observations on five different days disclosed "characteristic and very offensive odors" from the garbage reduction works of the Metropolitan By-Products Co., just off Staten Island, which treats the garbage of New York City, declares Theodore Horton, chief engineer of the New York State Department of Health, in a recent report to Dr. H. A. Biggs, commissioner of health. The observations were made by H. B. Cleveland, principal assistant engineer, and C. A. Holinquist, assistant engineer, the former observing on one day only. On all the days of observation the odor from the plant "covered a comparatively extensive area in the path of the wind and was readily discernible and offensive at a distance of 3½ to 4 miles," says Mr. Horton, and possibly at "considerably greater distances."

The plant, which was described at length in *Engineering News-Record* of Mar. 21, 1918, p. 555, was treating 750 tons of garbage a day at the time of the inspection. As to the source of the odors, Mr. Horton says that at the time of his report, which he calls "preliminary," he can make only general statements. These are as follows:

"We were told that two of the boiler units had not been in operation for several weeks, owing to imperfect or faulty construction; furthermore, that only 160 of the 198 reducers were in operation, owing to necessary repairs. In fact, the entire plant seemed to be working to the limit if not in excess of its capacity and several barge loads of unrendered garbage were seen stored on the waterfront.

"As a result of the conditions referred to and possibly to other remediable factors, objectionable odors were found to arise from certain parts of the plant; namely, from the raw garbage before its entrance to the plant; from the discharge of condenser water into the kills; from the open condenser tanks outside the buildings, and particularly from the tankage as it was being dumped from the reducers into conveyors and from which large volumes of gases and vapors escaped into the outside air."

From other sources than the report by Mr. Horton it appears that the reduction works are in the hands of receivers; that they have been declared a nuisance by a Richmond County grand jury and the superintendent has been indicted but not arrested; and that Mayor Hylan hopes to induce the Federal Government to take over the plant, since shutting it down would cut off a large output of grease and fertilizer base greatly needed at the present time.

Strong opposition to the location of the plant on Staten Island (really on a smaller island just off the larger island) led to an investigation by the State Department of Health and a report on probabilities by Prof. George C. Whipple in 1916. Professor Whipple's report on the subject was given in *Engineering News* of Jan. 18, 1917, p. 125. (See also Feb. 22, 1917, p. 329.)

Briefly, some nuisance at times was predicted both from the transportation of garbage in scows and its treatment at the plant, but it was declared that neither would "in any appreciable or material way affect the security of life or endanger the health of the people of Staten Island." These conclusions were endorsed by Dr. Linsly R. Williams, acting commissioner of health, in a report to Governor Whitman, who had ordered the investigation. Later Governor Whitman announced that he had no jurisdiction over anticipated nuisances. Editorial comment on this conclusion, with mention of the 1200 typewritten pages of testimony taken in the investigation appeared in *Engineering News* of Feb 1, 1917, p. 201. It may be added that Professor Whipple stated that from a sanitary standpoint either Riker's Island or Barren Island would have been better sites than Staten Island for the reduction works. The latter was barred by the specifications; the former by the Board of Aldermen. Professor Whipple also declared that "the Cotwell process (the one in question) is the best method now known and available for the disposal of the garbage of the City of New York."

Tribute Paid American Engineers in Pushing Marne Victory

It was stated recently by a prominent officer that the allied victory at the Marne rests largely upon the skill and resources of the Franco-American road-builders and other engineer units. It was asserted that an essential element of the allied success was the work done by our engineers in keeping open the highway system over which the reserves and heavy artillery were brought up to support the attacking troops. At the same time great crews of track layers, with thousands of coolies and other hardened workmen, were working night and day repairing the narrow-gage railroad lines worked in conjunction with the highways.

A later report from the battle front makes special note of the work of our engineers in throwing bridges over the Vesle River under heavy artillery and machine gun fire. While the infantry fighting was going on almost at their backs, the engineers did their bridge work, laboring on both banks of the river. Shell fire would destroy a half-constructed bridge, but the work would be resumed by the engineering units and pushed to completion. One detachment of twenty was reduced to fifteen and then to ten, and when relief came up there were only five remaining workers. At this point the Vesle is about fifty feet wide and from 5 to 8 ft. deep, which makes fording impossible and the bridge construction was effected under the most difficult conditions.

Shipping Board Opposes Army Shipbuilding

Water Transport Branch May Be Held Up on Its Small Concrete Boat Program

A decision of the War Industries Board announced Aug. 1 places the control of all shipbuilding in the United States fully in the power of the United States Shipping Board. The decision came as a result of a controversy between the board and the War Department, which through the office of the embarkation service of the war transport branch has been letting contracts for a number of small boats, mostly of concrete. The Shipping Board maintains that the letting of such contracts interferes materially with the progress of the United States shipping program as conducted by the board, and that all such contracts should be cleared through the Emergency Fleet Corporation.

The decision is in effect as follows: Each department ought to prepare its own plans and specifications for such ship or whatever craft it may require, conferring and collaborating from time to time with the Fleet Corporation to the end that uniform standards may prevail, but no contract for the construction of ships is to be placed by any Government agency until it has been cleared through the Emergency Fleet Corporation and through the War Industries Board. In the event of disagreement, the controversy is to be adjusted by the War Industries Board. Provision is also made for coöperation of the Fleet Corporation in the design of any ships supplied by any branch of the Government.

It has not yet been announced how this decision affects the contracts already let and the designs already made by the war transport branch, which is under the direction of General Goethals. This branch has been in existence since the Spanish War and has always built its own vessels. The recent designs have been for water boats to supply fresh water to transports and overseas freighters when in harbor, small river boats for transport service and car floats for harbor work.

The war transport branch appears to be very enthusiastic about the reinforced-concrete ship and is willing to proceed with a large program for their needs. So far there has been no announcement at the branch that they have any desire to build large ships of concrete, although the Emergency Fleet Corporation has under contract a number of steel transports for this branch of the Army.

University of Illinois to Aid in Work of Research Council

The National Research Council, acting as the department of science and research of the Council of National Defense, has appointed Prof. H. F. Moore of the Engineering Experiment Station, University of Illinois, as chairman of a committee to investigate the fatigue phenomena of metals. The committee is charged with the responsibility of developing a knowledge of the strength and durability of metals subjected to stresses, such as metals used in ship structures, crank shafts of aircraft engines and heavy ordnance. It is expected that much of the experimentation required will be done in the laboratories of the University of Illinois at Urbana under the personal direction of Professor Moore.

New Shipbuilding Records Made at Ecorse and Alameda

By launching a 3500-ton steel ship 14 days after its keel was laid the Ecorse, Mich., yard of the Great Lakes Engineering Co. July 26 set a new mark in high-speed shipbuilding. It represents an erection performance about one-fifth better than that made by the New York Shipbuilding Corporation three months ago in launching a 5500-ton vessel 27 days after keel-laying.

On Aug. 4 the Alameda, Cal., yard of the Bethlehem Shipbuilding Corporation launched a 12,000-ton vessel after only 24 working days. The keel was laid July 4, immediately after a hull of the same size was launched. The first rivet was driven July 5, on which date the first shell-plate was placed. All floors were in place and the tank top was started July 8. Fifteen days later the shelter-deck plating was being placed, and the next day testing the tanks was started. All shell-plating was on the vessel and the ways were ready for launching by July 31. About 40,000 rivets were driven daily on this hull, the Shipping Board states. Two days were lost through a strike.

San Francisco Railroad Terminals Consolidated

Western Pacific, Santa Fé and Southern Pacific terminals on the east side of San Francisco Bay will all be combined in the Oakland mole of the Southern Pacific Railway so that after Aug. 15 the regular ferries plying between Oakland and San Francisco will handle the traffic on all three lines as well as local business.

Engineers' Division Employment Service Working

Recent efforts of the shipbuilders at Hog Island, Philadelphia, to obtain thoroughly experienced draftsmen quickly through the Engineers' Division, United States Employment Service, Chicago, were so successful that 40 men were obtained in three days. This was done although practically every engineering office in Chicago to which previous appeal had been made wired back that no men of the necessary training and experience were available. Commenting on the service S. T. Henry, who went to Chicago for the American International Shipbuilding Co. to interview the men, stated that he found the office had at call all the men needed.

Another Step in Ten-Year Water Rate Suit

Court Holds Ordinance Confiscatory but Spring Valley Capital and Return Too High

San Francisco water rates for the eight years 1907-8 to 1914-15, as fixed annually by the city authorities until the control of rates passed to the State Railroad Commission, have been declared confiscatory by United States District Judge Frank C. Rudkin, in a decision handed down July 21. This sustains the general finding of Oct. 1, 1917, by Master-in-Chancery Wright, but the Wright valuation of $39,000,000 is cut to $34,000,000 and the 7% return allowed by Wright is reduced to 6%. Quoting from Judge Rudkin:

"The valuation fixed by the master varies from $32,900,000 in 1907-08 to $39,000,000 in 1913-14 and 1914-15. The net revenue varies from $696,648.74, or 2.1%, in 1907-08 to $1,654,589.87, or 4.24% in 1914-15. The highest rate of return was therefore during the last year, and if the ordinance for that year is declared noncompensatory and void the same conclusion must follow in each of the earlier cases as a matter of course. The valuation for the year 1914-15 has been reduced from $39,000,000 to $34,000,000. A net return of 6% on that valuation is $2,040,000, or approximately $385,000 in excess of the ordinance rates. During each of the years in question a temporary restraining order was granted by the court and the plaintiff was permitted to and did collect approximately 15% in excess of the ordinance rates. The actual net return during the year 1914-15, with this 15% added, was $2,011,904, or less than 6% on the valuation as found and fixed by the court. For these reasons I feel constrained to hold that each and all of the several ordinances are violative of the Constitution of the United States and therefore void."

The $5,000,000 reduction in valuation included about $1,500,000 each for Lake Merced lands and for water rights and some $2,000,000 for going value. The water company contended for the full market value of the Lake Merced lands. The master made a heavy reduction in this claim and the court cut this allowance more than in half, arguing that the company was claiming more than $6,000,000 for lands, reservoirs and water rights which yield less than one-tenth of the total water-supply of the city. The master placed a value of $90,000 per 1,000,000 gallons on the daily available water-supply in 1913-15. The court says: "I am far from convinced that these winter flood waters going wildly to the sea are worth $90,000 per 1,000,000 gallons, or even a small part of that sum." The court's allowance for Lake Merced lands was $1,742,000; for water rights, $1,560,000; and for going value, $1,400,000.

In justification of cutting the master's allowance of return on valuation from 7% to 6% the court said:

"Cases may doubtless be found in which the trial courts have found that public service corporations were entitled to a return of 7% or even as high as 8% on the capital invested in certain enterprises. I have found no case where the Supreme Court has held that a less rate of return than 7% is confiscatory or violative of the Constitution. I deem a 7% return in this case excessive and fix it at 6 per cent."

Altogether, the company is allowed $2,287,675 additional rates, which it appears is 15% in excess of the ordinance rates plus interest on the sum already impounded by court order. Although the case has been pending for 10 years it may yet go to the United States Circuit Court of Appeals.

Cannot Build Garbage Incinerator on Site Chosen

Construction of a garbage incinerator on the particular site chosen by the City of Quitman, Ga., has been enjoined. A suit for an injunction was brought by F. P. Underwood and other property owners represented by Branch & Snow, Quitman. The plaintiffs alleged that the incinerator was being erected in the residence section of Quitman, about 100 yd. from residences and 400 yd. from the heart of the city; that the constant hauling of refuse past the houses of the plaintiffs and the dumping of it at the incinerator would cause flies to congregate in the neighborhood, endanger the health of the residents and cause offense and a deterioration of property values. The plaintiffs contended that the incinerator might just as well have been built on the outskirts of the city, at a distance from the residences. The present decision confirms the judgment of a lower court. The incinerator was being built for the city by the Nye Odorless Crematory Co., Macon, Ga. Copies of the decision, which is short, may be obtained from the clerk of the Supreme Court, Atlanta, Ga.

Engineering Institute of Canada Holds Second General Meeting

The second general professional meeting of the Engineering Institute of Canada, in Saskatoon, Province of Saskatchewan, was scheduled for today. The subject of the first afternoon session of the meeting is "Good Roads." This evening's session is to be devoted to the reading of papers on "Rural Community Water Supplies," and "General Water Supply for Saskatchewan," followed by discussion.

The session of the meeting to be held on the morning of Aug. 9 will be devoted to the reading of papers and discussions on concrete engineering. The session of the afternoon of the same day will be devoted to the discussion of subjects relating to fuels. The fifth session, on the morning of Aug. 10, will be given over to professional and institute affairs, including papers on "Legislation Governing the Status of Engineers" and other subjects of current interest to engineers.

Additional Housing Boards Named

Project boards on two more housing developments have been named by the bureau of industrial housing and transportation of the Department of Labor. One of these is at Staten Island, New York harbor, and the other covers three separate projects in the three cities adjacent to the Muscle Shoals nitrate plant on the Tennessee River. The engineers, architects and town planners are given in the following table, which is an addition to the earlier table in *Engineering News-Record* of July 25, p. 197.

Project	Architect	Town Planner	Engineer
Staten Island, N. Y.	Delano & Aldrich, N. Y.	A. F. Brinkerhoff, N. Y.	C. S. Pollok, N. Y.
Florence, Sheffield, Tuscumbia, Ala. (Muscle Shoals)	Warren & Knight, Birmingham	H. A. Caparn, N. Y.	Julian Kendrick, Birmingham

The same department has announced that the contract for the construction of about 1000 houses adjacent to the navy yard at Portsmouth, Va., has been let to the Hegaman-Harris Co., New York City. Residential hall construction at Washington, D. C., is to be built by the George A. Fuller Co., New York City.

San Francisco Societies to Form Joint Council

Plans have recently been adopted for a joint council to coördinate the activities of the five San Francisco sections of national engineering societies. The societies included are those of the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers and the American Chemical Society. The tendency toward moves of this sort has been felt on the coast for some time, and in some cities, notably Los Angeles and Seattle, it has already taken definite shape and made progress. San Francisco is considered a particularly promising field for such activity because the Engineers' Club constitutes a ready-made nucleus, a going concern with headquarters and organization able to help out materially in the work of a joint council.

At a recent joint meeting of the five sections, mentioned in *Engineering News-Record* of Aug. 1, p. 248, at which the plan was considered, details were touched upon by way of suggestion, but the adoption of a working plan was left to the representatives of the several associations, who will form the first joint council. The purposes of the joint council, however, were clearly set forth. Primarily, they are to foster closer touch and coöperation so that there will be greater efficiency in all five sections in war service matters and in service to the membership. Attention is to be given to all benefits of inter-organization such as economy of time and funds, the elimination of duplication of effort and the calling together of the memberships whenever joint meetings are desirable. Moreover, the joint council is to study the plan and program of joint meetings to the end that these shall have purposeful direction and their tone and spirit shall trend, meeting by meeting, toward the common purpose of closer touch and greater helpfulness.

Additional Water-Supply for Newark Proposed

After four months' study, John R. Freeman, consulting engineer, Providence, R. I., assisted on the ground by R. D. Chase, has reported in favor of an additional water-supply for Newark, N. J., to be drawn from the Wanaque River. In general, the plan appears to be the same as that proposed for some time past, only Mr. Freeman urges that Newark should carry out the work itself, instead of in coöperation with other municipalities, whereas Newark has been considering a coöperative scheme for some time. In any case, a new supply scheme must be approved by the North Jersey Water Supply Commission. The Freeman recommendations are chiefly for storage works supplementary to the present supply from the Pequonnock River. Considerable additional storage might be provided in the present drainage area if litigation brought or proposed by East Jersey Water Co. interests holds up the Wanaque project too long. The Newark City Commission, on July 25, voted unanimously for entering into a tentative contract with the district water commission for the Wanaque scheme. It appears that nothing final can be done until approval by the Capital Issues Committee has been obtained.

New Bessemer & Lake Erie Bridge Rolled Into Place

Successful completion of the new Bessemer & Lake Erie R.R. bridge over the Allegheny River, a continuous-truss steel structure more than 2100 ft. long, was achieved on July 22 and July 31 by rolling the two continuous sections 16 ft. 3 in. laterally to final alignment. The work was done by the erection forces of the American Bridge Co., which had previously taken down the old bridge after erection and adjustment of the new structure alongside the old, on extensions of the piers.

The new bridge, which is a double-track deck structure, consists of two groups of three spans, each group being continuous over the two intermediate piers. The south group is 1140 ft. long, and the north 968 ft. Two approach spans adjoin at the north end.

The south span-group, weighing 6800 tons, was rolled 16 ft. 3 in. into its final position on July 22. On account of the heavy dead-load reactions and the fact that there are only one fixed and three rocker expansion points, it was not considered advisable to carry traffic on the temporary rollers. Therefore all of these rollers, except those

under one truss at two piers, had to be put in place after the track was broken.

Track was cut at 8:30 a.m.; jacking stated at 8:50, and all the rollers were in place and the equipment was ready for rolling at 11. The rolling started at 11:17, and the actual rolling time was 11 min. and 5 sec. The pulling tackle consisted of 20 parts of ¾-in. wire rope leading to 60-ton locomotive cranes at the center piers, and 13 parts leading to standard 50-hp. hoisting engines at the ends. Owing to the length and flexibility of the spans it was necessary to maintain alignment, which was done by means of a transit and range boards. All the engines and piers were connected by telephones to a central control station, from which operations were directed. After the span was in final alignment it was jacked down 8¾ in. Traffic was resumed at 2:10 p.m.

The other group of spans, 968 ft. long, weighing 5400 tons, was rolled in the same way July 31. Owing to the experience gained on the first operation, the time consumed was materially reduced. Track was cut at 9:09 a.m. and traffic was resumed at 1:25 p.m., while the actual rolling time was 5 minutes 33 seconds.

Contracts Let for New York Canal Concrete Barges

Contracts have been let by the inland waterways committee of the railroad administration for twenty-one 500-ton concrete barges to be used on the New York State Barge Canal. The design of these barges is described in detail on p. 271 of this issue.

Eight barges are to be built by the Holler-Davis & Flood Co., at Fort Edward, N. Y.; five by Thomas & Currie, at Detroit, Mich.; four by Caldwell-Marshall Co., at Tonawanda, N. Y., and four by the Cummings Concrete Constructural Engineering Co., at Ithaca, N. Y.

For the 21 barges contracted for the price will average $25,000 each. They must all be delivered before the close of navigation in the canal this year, or approximately Dec. 1, 1918.

New Conduit Bids at Jersey City

Informality of bids for 72-in. steel pipe to duplicate the Jersey City water-supply conduit from the Boonton reservoir to the Watchung tunnel has made it necessary to reject the bids for the pipe and to return unopened bids for pipe laying received July 30. New bids for supplying and for laying the pipe will be received Aug. 13, half of the pipe to be delivered within 2½ months from the date of the execution of the contract and half within five months. This will enable half of the new conduit to be connected with the old one before extreme cold weather, it is hoped, thus adding 10,000,000 gal. to the water-supply. The informal bids received were from the Riter-Conley Co. and the James McNeil & Bro. Co., both of Pittsburgh. Each company inserted in its proposal conditions not in the specifications and the McNeil bid was not accompanied by the required bond.

Study New Mississippi Crossing at New Orleans

The City of New Orleans has recently appointed a board of advisory engineers of the Public Belt Railroad Commission for the purpose of investigating the physical and financial feasibility of a bridge or tunnel crossing of the Mississippi River at or in the vicinity of the city, also the possibilities of united terminal development, both passenger and freight, through the agency of the Public Belt Railroad.

The board consists of four members: Lt. Col. Bion J. Arnold, transportation engineer, Chicago, chairman; Dr. J. A. L. Waddell, bridge engineer, Kansas City; J. Vipond Davies, tunnel engineer, New York, and A. F. Barclay, engineer of the Public Belt Railroad Commission, secretary. The board is working under the general direction of the bridge and tunnels committee of the commission, of which William B. Bloomfield is chairman.

The possibilities of bridge and tunnel construction will be investigated by Dr. Waddell and Mr. Davies, respectively, and the problem of terminal development and general coördination of facilities will be studied by Colonel Arnold. The board as a whole is instructed to submit a report by Jan. 1, 1919.

The field work has commenced, and is in charge of J. R. Bibbins, Chicago; Charles K. Allen, Kansas City, and A. R. Archer, New York, resident engineers and representatives of the respective consulting engineers on the board.

The problem presented is complex not only by reason of the physical dimensions of the crossing project and the foundation difficulties encountered in the bottom lands around New Orleans, but also because of the disposition of present railroad operations, traffic and rates in the Mississippi Valley, and the possible effect in the future of railroad reorganization brought about by war conditions. The project as a whole is to be designed for permanent improvement, having in mind the development of the New Orleans district as far ahead as 1950.

North Carolina Holds Good Roads Convention at Wilmington

The North Carolina Good Roads Association and the Wilmington Highway Association are holding a joint good roads convention at Wrightsville Beach, Wilmington, Aug. 7-9 inclusive. Among those who will deliver addresses are: W. S. Fallis, state highway engineer; L. R. Ferguson, general manager of the Liberty Shipbuilding Co.; H. G. Shirley, secretary of the Highways Industries Association, and John W. Towle, government representative, Emergency Fleet Corporation. One of the topics of discussion is military highways along the Atlantic coast.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Sept. 2, Denver, and Sept. 3, Colorado Springs, Col.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS; Pittsburgh; Sept. 9-13, Baltimore.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS; 304 East Walnut St., Bloomington, Ill.; Oct. 2-4, Buffalo, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Boston.

PERSONAL NOTES

J. C. SPENCER, consulting engineer, Cleveland, has been admitted to practice as an attorney and counselor at law, and will specialize upon law relating to engineering, architectural and construction work. Mr. Spencer has been engaged in engineering and structural work since 1891, going to Cleveland in 1902 as designing engineer for coal- and ore-handling storage plants for the Brown Hoisting Machinery Co. In 1903 Mr. Spencer became designing engineer for the American Bridge Co., at Pittsburgh. He designed and was consulting engineer for the steel work of the 17-story office building for J. D. Rockefeller at Cleveland.

WILLIAM D'ESMOND, who has been in charge of the waterfront work and pier inspection at Honolulu, T. H., has been appointed harbor engineer of that city. For several years past the legislature has failed to provide an appropriation for salary attached to the position of harbor engineer, and the position was abolished. It has recently been recreated by the Board of Harbor Commissioners.

C. C. SANER, designing engineer, city engineer's office, Chicago, has received leave of absence to become structural checker for the American International Shipbuilding Corporation, at Hog Island.

H. C. BOOZ, assistant chief engineer of the Pennsylvania R.R., has been appointed corporate engineer, in the employ of the company. Mr. Booz has been continuously in the employ of the

Pennsylvania since shortly after his graduation from Lafayette College in 1895. In 1899 he was made division engineer, in 1905, principal assistant engineer and in 1911, assistant chief engineer.

O. E. CARR has resigned as city manager of Niagara Falls, N. Y., to accept the city managership of Springfield, Ohio, from which Charles D. Ashburner resigned to become city manager of Norfolk, Va., as mentioned in *Engineering News-Record* of July 11, p. 105. Mr. Carr has been city manager of Niagara Falls for the past 2½ years, being the first to hold the position.

GEORGE M. ZIMMERMAN, who resigned as city manager of Sandusky, Ohio, as mentioned in *Engineering News-Record* of June 20, p. 1204, has reconsidered his resignation, deciding to remain as city manager upon announcement that the city commission had voted a considerable increase in salary. Mr. Zimmerman was to have taken over the management of the plant of the Hord Color Products Co., Sandusky, in which he is a stockholder.

LINDEN C. TROW, water-works superintendent, Lake Forest, Ill., has been commissioned a captain in the maintenance and repair branch of the Construction Division.

CHARLES GARRETT, Montreal, has been appointed assistant to the administrative commission of that city.

R. BOONE ABBOTT, superintendent of the Harrisburg division, Philadelphia & Reading R.R., and previously division engineer of that division, has been transferred and is now superintendent of the New York division.

J. M. GRANT, engineer maintenance of way of the Chicago, Peoria & St. Louis R.R., has been commissioned a captain in the Engineer Officers' Reserve Corps.

EDGAR M. HOOPES, JR., chief engineer of the city engineering and water departments of Wilmington, Del., has resigned to enter Government service.

R. W. KENNEDY, assistant valuation engineer of the Atchison, Topeka & Santa Fe Ry. at Topeka, Kan., has entered the United States Army.

E. T. AMBACH has been appointed engineer of signals for the Baltimore & Ohio R.R., Lines West, the Dayton & Union R.R. and the Dayton & Union Ry., with headquarters at Cincinnati.

E. J. LORD, civil engineer and contractor, of Honolulu, T. H., has resigned as head of the Lord-Young Engineering Co. of that city. It is reported that Mr. Lord's resignation is the result of the reorganization of the H. Hackfeld Co., which owns nine-tenths of the stock in the Lord-Young corporation and which has negotiated with Dillingham & Co. for the sale of its stock.

ERNEST A. CLARK, associated for many years with George W. Jackson, Chicago tunnel contractor, has been commissioned a captain in the Engineer Officers' Reserve Corps.

L. W. STRAYER, assistant division engineer of the Baltimore & Ohio R.R., has been appointed division engineer of the New Castle division, with headquarters at New Castle, Penn.

J. G. RODGERS has been appointed engineer maintenance of way and equipment for the Pennsylvania Railroad Company.

DEAN O. CARR, designer, Illinois Steel Co., Chicago, has been commissioned a captain in the Engineer Officers' Reserve Corps.

A. E. DOUCET, Montreal, has been appointed consulting engineer to the administrative commission of the City of Montreal.

A. H. GRIFFITH has been appointed engineer of construction for the Baltimore & Ohio R.R., Lines West, the Dayton Union R.R. and the Dayton Union Ry., with headquarters at Cincinnati.

M. L. WORRELL, engineer and manager of the Water Department, Meridian, Miss., has been commissioned a captain in the maintenance and repair branch of the Construction Division and assigned to duty as assistant officer in charge of utilities at Camp Logan, Texas.

DAVID FOWLER ATKINS, for the past four years chief engineer of the Light & Power Co. of the City of New York, has become associated with the Lord Electric Company.

THOMAS W. HULME, real estate agent of the Pennsylvania R.R. and vice-chairman of the Presidents' Conference Committee, has been appointed general real estate agent for the Pennsylvania railroad corporation.

R. C. FALCONER, assistant chief engineer of the Erie R.R. prior to its taking over by the Government, has been appointed chief engineer for the corporation. Mr. Falconer was graduated from the University of Wisconsin in 1895. He began railway service three years later as transitman on the Pennsylvania Lines West of Pittsburgh. In 1905 he entered the employ of the Erie, and was successively assistant engineer, division engineer, principal assistant engineer, superintendent of construction and assistant chief engineer.

HOWARD STILWELL, previously with the firm of Solomon-Norcross Co., consulting engineers, Atlanta, has been commissioned as second lieutenant in the Construction Division.

LELAND P. KIMBALL, assistant engineer, attached to the office of the chief engineer, Illinois Central R.R., has been appointed engineer of buildings for the Baltimore & Ohio R.R., Lines West, with headquarters at Cincinnati. Mr. Kimball entered railway service in the operating department of the Illinois Central in 1904, being transferred to the engineering department a year later, and was subsequently promoted through the positions of rodman, instrument man, inspector and assistant engineer in the maintenance, construction and bridge departments. In 1915 he became chief draftsman in the building department, and in May of this year was appointed assistant engineer in the chief engineer's office.

C. H. MATTIER, assistant engineer, Illinois Central R.R., engaged on terminal work in Chicago, has been appointed assistant engineer in the chief engineer's office, succeeding L. P. Kimball, who has become engineer of buildings for the Baltimore & Ohio R.R., Lines West, as mentioned in the preceding paragraph.

S. J. WILLIAMS, who has been engineer for the industrial division of the Wisconsin State Department of Engineering since its organization, has resigned to become manager of the accident prevention division of the National Safety Council, Chicago.

A. B. SCOWDEN, assistant engineer of bridges of the Baltimore & Ohio R.R. at Baltimore, has been appointed engineer of bridges of the western lines, with headquarters at Cincinnati.

STUART B. MARSHALL, formerly manager of the American Manganese Mfg. Co., Dunbar, Penn., and until recently general superintendent of the Aluminum Co. of America's properties at Badin, N. C., has entered private practice, with headquarters at Roanoke, Va., as consulting engineer and metallurgist for coal and oil lands.

C. H. STEIN, superintendent of the Central R.R. of New Jersey at Jersey City, has been appointed assistant to the general manager of that road, the Philadelphia & Reading and subsidiary lines. Mr. Stein was formerly engineer maintenance of way of the Central R.R. of New Jersey.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Will Localize Purchases of Construction Material

Relief of Railroads, Not Antagonism, Reason for Discrimination in Government Buying

Conservation of freight space is the sole reason given by L. E. Kern of the housing corporation, for discrimination that may occur in the purchase of construction material for the United States Government. There has been some complaint on the part of certain manufacturers that there seems to be antagonism to or lack of appreciation of their products which, they assert, has resulted in greatly reduced sales to the various departments.

The expansion of structural activities throughout the entire Government field and the official and economic restrictions in the private field have produced marked attention on the part of manufacturers to Government business. Those not familiar with the usual official procedure have chafed under what seemed to them unnecessary and hurtful regulations. Furthermore, the housing demand has enlarged so suddenly in certain departments, especially the war and navy, that the Government was forced to produce structures immediately, regardless of kind of material or type of construction. Maj. H. W. Lockett of the construction division of the Army said that in the case of stucco and metal lath construction especially it was not antagonism that has so far restricted the use of this material, but that there had not been time to apply the use of it to its full extent. He stated further that it is his intention to use it wherever possible.

COSTS OF WOOD AND STUCCO

He has compiled some comparative costs from the work at Camp Eustis, Virginia, which include only the labor and material figures, exclusive of plumbing, electric and heating fixtures, and which show a difference between wood and stucco of from 5 to 10 per cent. They are as follows: For a 66-man, two-story barracks 30 x 60 ft., wood construction $4302, stucco $4570, showing a difference of 6% between the wood and the stucco; officers' quarters, two-story, 30 x 77 ft., wood $6356, stucco $6661, a difference of 5%; lavatories, one-story, 20 x 49 ft., wood $1442, stucco $1550, or 7½%; mess hall, one-story, 20 x 154 ft., wood $3636, stucco $3893, or 7½%; storehouses, 20 x 98 ft., wood $1706, stucco, $1883, or 10½ per cent. Major Lockett estimated that in the cost of the completed structures, after overhead, plumbing, etc., shall have been added, the margin will be reduced to 5%, and pointed out that the lower maintenance cost of the stucco would soon equalize even the 5% difference. He estimated that in heating alone there will be a saving of 18%.

L. E. Kern, of the requirements division of the housing corporation, Department of Labor, also stated that it was too early in the game to say that any one material would be used in preference to others. This, he said, was especially true in the housing corporation, since it was only three weeks since the first contract was let. He said his greatest difficulty at present was that, no matter what material was specified, he received complaints from dealers in other materials that could have been used for the same purpose. As an illustration, he pointed to the matter of slate roofs, which when specified brought a protest from the makers of composition roofing, and vice versa. He said that this condition arose from a misunderstanding among the material men, in that heretofore the largest part of Government construction was specified by fixed, standard specifications, and that the material men were under the impression that the housing corporation was formulating similar standard specifications and were anxious to have their materials covered. But, he stated that at present there were no standard specifications contemplated, and that before the housing program was complete the demand would be so great that all kinds of construction would be used.

George W. Ginder, superintendent of the computing division of the United States Supervising Architect's office, under whom the specifications are written, said that he preferred and always

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Turbine Industries Controlled by War Industries Board

All orders for turbines rated at 700 hp. and over will be supervised by the War Industries Board. Twenty-one companies manufacturing turbines will be affected by this order, and have agreed not to fill orders for turbines in excess of 700 hp. for either civilian or Government purposes before obtaining permits from the War Industries Board. Orders from the Navy and the Emergency Fleet Corporation are excepted, as well as land type machines, orders for which may be received and filled without permit. Permits are required for all private or nonwar orders, and will be given only when necessity is shown.

Preliminary Rules for Labor Recruiting Outlined

Backed by Announcement of Industries Board of Intention to Withhold Priorities From Offenders

Preliminary rules and regulations under which recruiting of unskilled labor will be conducted under the United States Employment Service have been announced through the chairman of the War Labor Policies Board and the Director General of the Employment Service, backed by the War Industries Board, which, through its priorities division, will in proper cases withhold priorities from employers violating the rules set down by the United States Employment Service. An outline of the employment program of the Government was given in *Engineering News-Record* of June 27, p. 1245, pointing out the probability of the War Industries Board coöperating with the Employment Service through withholding priority assistance to employers who violated the rules prescribed. The intensive campaign for recruiting labor in war industries was outlined in *Engineering News-Record* of Aug. 1, p. 250.

As announced by the United States Employment Service the regulations which govern private recruiting are as follows:

1. Employers may continue to hire workers who apply at the plant without solicitation, direct or indirect.

2. The Federal Director of Employment in each state is authorized to grant permission to employers to use their own field agents for recruiting unskilled workers under his direction and control for war industries located within the state.

3. Permission to recruit unskilled laborers in states other than the one in which the work is located may be secured from the Director General of the United States Employment Service upon the recommendation of the Federal Director of Employment for the state in which the men are needed. Such permission will be communicated by the Director General to the Federal Directors for the states in which the labor is needed and from which it is to be recruited.

4. No unskilled labor may be transported from one state to another without authorization from the Director General, to be secured by application through the Federal Director of Employment for the state in which the labor is recruited. No laborers may be moved from one employment district to another within a state without author-

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Construction Materials Purchases

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specified either a heavy wire mesh or metal lath, except under unusual circumstances. The choice was always one of economy in the locality where the building was to be built. He stated that owing to conditions terra cotta shortly would be so difficult to obtain as to be practically off the market, in which case, he said, expanded metal and stucco would be extensively used as a substitute.

The housing corporation has reduced to a system the allocation of purchases to conserve freight space and it is the application of this system that has given rise to the complaints of the material men. The country is divided into districts, each of which is supervised by an architect. He is selected with reference to his familiarity with the local conditions of the district to which he is assigned or preferably to his actual experience therein, and among his instructions is a set of multigraphed sheets the subject of which is "Availability of Materials for Industrial Housing Projects" (as determined at meetings held in office of R. L. Humphrey, May 31 and June 1, 6 and 7, 1918, and as revised and added to at a meeting held in the same office on July 18, 1918.)" Under the heading this note says, "Wherever possible architects should so design projects that the material requirements will be equitably divided among the various available branches of the building material industries." The body of the list is divided into sections to cover each locality in which construction will be done and of which a more or less composite example follows:

City of A, State of B.

(a) Frame, metal lath and stucco

(b) Brick

(c) Tile with or without stucco

Lumber: Norway pine by Great Lakes, probably Spruce and hemlock
Brick, T. C. tile, Northern N. J.
Cement: Lehigh
Sand and gravel
Metal Lath, 100,000 yd. in stock in Pittsburgh
Lime: Buffalo and Glens Falls
Gypsum: 200-mile haul
Prepared roofing: 45-mile haul, etc., etc., etc.

The above is disguised at the request of the housing corporation because the list is subject to change at any time, and is for the use of the district supervising architects. It is noted, however, that in almost all the cities of the list, metal lath is specified.

These specifications, Mr. Kern stated, were carefully compiled so that materials produced in or in the vicinity of the cities and localities covered might be used, and were made irrespective of the size of stocks of materials produced in other localities from which there would be a lengthy freight haul. In Norfolk, for instance, wood-lath and nonfireproof construction was specified for immediate economy and because wood-lath was extensively used there previously. This had to be done in spite of the fact that large stocks of metal lath are stored there.

Mr. Kern invites attention to another phase of the housing program in that the type of buildings is more or less determined by the use to which they will be put. For instance, skilled mechanics will demand a house of a much higher order than immigrant labor, he says, and in certain localities custom demands a certain type of construction, and he says a comparison between the houses being built and similar houses built before the war will show an improvement in construction.

Zenas M. Carter, commissioner at Washington for the association of metal lath manufacturers, is of the opinion, however, that the housing corporation might be following custom more closely than the situation requires, and in the matter of economy that Mr. Kern outlines Mr. Carter invites attention to the fact that in many of the brick and tile structures the costs are higher than stucco, and that a much less durable interior finish is obtained with the plaster boards the housing corporation is specifying, the maintenance cost of which will produce in a short time a balance in favor of metal lath. Mr. Carter also states that he has heard that, in some cases, brick and tile were specified in localities in which they are not produced, making freight hauls necessary. Lack of specified instances makes it impossible for the housing corporation to explain the conditions which made this necessary, but Mr. Carter points out that, owing to the wide distribution of sand and gravel, it is possible to maintain economy of freight haul by the use of stucco even if it is necessary to ship the metal lath. In illustration of this the metal lath association has made a study of car requirements for two types of construction, in which a saving of from 36 to 42 cars hauled is shown in two comparisons between wood and stucco.

Labor Recruiting

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ization from the Federal Director of Employment for the state.

5. Employers who receive permission to transfer workers from one state to another or from one district to another within any state must file a statement with the nearest employment service office, of the number of men transferred, the wages offered, and other terms and conditions of employment promised to the men.

6. Employers who are permitted to use their own field agents for recruiting labor must in no case use any fee-charging agency, or use any agents or labor scouts who are paid for their work on a commission basis.

7. All advertising for unskilled labor, whether by card, poster, newspaper, handbill, or any other medium, is prohibited after Aug. 1, 1918. This applies to all employers engaged wholly or partly in war work, whose maximum force, including skilled and unskilled laborers, exceeds 100.

The Federal directors of the employment service for the several states are instructed to give every possible assistance to employers engaged in war work who desire to recruit skilled labor.

For the time being no restrictions have been placed upon employers engaged in war work recruiting their own skilled labor, except that they are urged to conduct their efforts so that as little restlessness as possible will be caused among men who are already engaged in other war work, including railroads, mines and farms, as well as work cov ered by direct and subcontracts for departments of the United States Government.

Business Notes

R. H. Johnston, formerly New York manager, is now vice-president of the White Co., Cleveland, manufacturer of White automobiles. Mr. Johnston's headquarters will be at Washington, D. C., and he will be succeeded in New York by William H. Moore, who has been in charge of the Pittsburgh offices.

The Electric Hoist Manufacturers' Association held its recent meeting at Montour Falls, N. Y., where the members of the association were the guests of the Shepard Electric Crane & Hoist Co. Twenty-two members were present, representing eight companies in the East and Middle West.

Trade Publications

The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has issued the May, 1918, number of the Deane Bulletin, D-702, a 55-p. pamphlet illustrating the single and double acting vertical triplex power pumps manufactured by the Deane Works of the corporation, at Holyoke, Mass.

"The New Era in Street Lighting" is the title of a 36-p. catalog recently published by the Holophane Glass Co., 340 Madison Avenue, New York City. This book describes and illustrates the results of recent research and shows how these results have been applied to street lighting.

Sixty-nine war activities, Federal, state, county, city and private, centering in Madison, Wis., are described in a 36-p. paper-covered booklet issued by the Madison Association of Commerce, Don E. Mowry is general secretary of the association.